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The Mining Magazine

Edited by T. A. RICKARD.

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THE MINING MAGAZINE

STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Meriton & Co. Tons of 2,240 lb.

	Oct 31 Tons	Nov 30 Tons	Dec. 31 Tons
In England	28,377	26,818	27,764
In France	6,923	4,871	4,396
Afloat from Chile	2,400	2,225	2,800
Afloat from Australia	5,681	6,300	5,400
In Rotterdam	700	350	1,000
In Hamburg	2,311	2,215	1,882
Total European visible supply	46,311	43,281	43,211

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES
In Tons of 2,240 lb.

	Deliveries			Stocks at end of month
	Produce Total	Domestic	Foreign	
Total, 1911	632,258	316,791	337,009	653,800
January 1912	53,272	27,832	35,789	63,621
February	51,801	25,101	28,191	53,292
March	56,114	30,128	36,211	56,361
April	56,011	31,033	23,773	54,806
May	56,570	32,476	31,040	63,176
June	51,605	29,521	27,434	56,955
July	61,233	31,738	26,800	58,578
August	65,013	35,134	31,467	60,611
September	62,510	28,331	26,904	55,234
October	64,913	37,500	21,259	58,506
November	60,132	30,970	21,959	55,429
December	63,997	26,112	29,330	55,448

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand		Else- where		Total	Value
	Oz.	£	Oz.	£		
January 1912	709,280	27,780	737,360	3,130,830		
February	674,900	28,906	703,806	2,989,832		
March	796,755	33,968	830,723	3,528,688		
April	706,763	30,897	737,660	3,133,383		
May	746,988	33,714	780,702	3,311,794		
June	722,588	31,348	753,936	3,025,517		
July	735,941	30,397	766,338	3,255,198		
August	752,197	32,540	784,737	3,248,395		
September	716,495	31,398	747,893	3,176,846		
October	738,082	30,599	768,681	3,265,150		
November	727,099	24,638	751,737	3,216,965		
December	745,860	30,546	776,406	3,297,962		
Year 1912	8,753,563	370,731	9,124,294	38,757,560		

* Including 70,143 oz. worth £2,979,946 extinguished reserve.

COST AND PROFIT ON THE RAND

	Tons	Yield		Cost		Profit		Total profit
		per ton	per ton	per ton	per ton	per ton	per ton	
1911	23,888,260	s.	d.	s.	d.	s.	d.	£
January 1912	2,067,161	27	6	18	0	9	7	11,414,863
February	1,984,136	28	3	19	2	9	2	907,192
March	2,163,988	28	1	18	11	9	0	1,214,764
April	2,034,992	28	6	19	0	8	8	1,695,920
May	2,177,348	28	6	18	9	9	10	1,073,534
June	2,110,957	28	5	18	6	10	1	1,063,634
July	2,149,785	28	6	18	8	9	11	1,061,989
August	2,121,455	28	9	18	10	10	0	1,955,315
September	2,081,295	28	7	18	8	10	0	1,040,820
October	2,097,079	28	0	18	3	9	10	1,079,334
November	2,155,020	28	2	18	5	9	10	1,059,964

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
January 31, 1912	184,096	7,805	9,524	201,375
February 29	170,820	7,922	10,789	209,301
March 31	196,745	8,198	12,071	217,017
April 30	187,637	8,364	13,785	210,874
May 31	193,829	8,460	14,558	216,827
June 30	188,394	8,549	15,530	212,573
July 31	172,925	8,497	15,884	207,256
August 31	184,111	8,766	15,934	209,811
September 30	180,779	8,753	15,752	205,274
October 31	182,458	8,803	15,496	206,357
November 30	186,881	8,767	14,872	210,520
December 31	171,316	8,634	14,465	214,915

GOLD OUTPUT OF INDIA

Year 1910	Year 1911	Dec. 1912	Year 1912
£2,104,858	£2,150,050	£201,001	£2,265,094

PRODUCTION OF GOLD IN RHODESIA.

Month	1908		1909		1910		1912	
	Oz.	£	Oz.	£	Oz.	£	Oz.	£
January	199,388	204,666	227,511	214,918	191,635	192,497	203,888	209,744
February	200,615	202,157	228,385	215,102	213,935	222,780	228,213	231,476
March	223,867	225,032	234,888	234,407	224,920	217,600	214,709	214,307
April	228,151	225,231	235,233	240,514	230,792	228,296	191,423	195,233
May	230,792	228,296	233,249	230,573	205,496	222,653	231,928	230,072
June	204,262	213,249	178,950	220,957	196,668	236,307	204,573	225,957
July	217,316	233,397	199,500	—	—	—	—	—
August	—	—	—	—	—	—	—	—
September	—	—	—	—	—	—	—	—
October	—	—	—	—	—	—	—	—
November	—	—	—	—	—	—	—	—
December	—	—	—	—	—	—	—	—
Totals	2,526,007	2,623,788	2,568,201	—	—	—	—	—

PRODUCTION OF GOLD IN WEST AFRICA.

Month	1910		1911		1912	
	Oz.	Value	Oz.	Value	Oz.	Value
January	17,357	70,699	15,903	66,107	26,098	107,262
February	16,976	68,469	15,179	63,081	25,109	102,270
March	17,627	71,954	16,387	67,673	27,228	111,376
April	16,363	67,069	17,237	70,880	27,790	114,796
May	16,590	68,355	24,427	96,409	28,015	115,678
June	17,194	70,988	22,555	92,174	27,784	114,697
July	15,564	58,551	22,510	91,955	30,974	127,800
August	13,921	57,713	25,385	103,753	33,015	136,407
September	11,497	47,746	26,717	109,039	34,491	142,397
October	13,341	55,046	26,826	109,503	34,436	142,414
November	14,021	57,658	24,289	99,299	33,183	137,700
December	15,042	61,737	24,369	99,569	—	—
Totals	185,493	755,985	261,784	1,069,442	—	—

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.		Mint oz.		Total oz.		Total Value £	
	1910	1911	1910	1911	1910	1911	1910	1911
Total, 1910	363,496	1,209,856	1,573,352	6,682,042	160,021	1,210,447	1,370,468	5,823,522
January 1912	10,697	95,673	106,370	451,828	10,441	92,091	102,532	435,526
February	408	92,597	93,005	395,058	10,608	94,708	110,406	468,972
March	9,288	98,104	107,392					

REVIEW OF MINING

INTRODUCTORY.—The New Year has not begun its career under the assurance of peace, but indications are favourable for that desired consummation, despite the wearisome delays of Turkish diplomacy. By discounting the issue of the Peace Conference, a more cheerful tone has prevailed. The quotations for Transvaal mines have shown some recovery, aided by the continued good returns from the deep-level mines of the eastern Rand and a decrease of operating cost at many of the older mines of the central Rand. Rhodesians are as dull as they deserve to be. West Africans, both gold and tin mining companies, have been cheered by two or three dividends. An attempt to jog the Nigerian department was not successful, and it is well that it failed, for much real mining remains to be done before another upward movement of prices is warranted. A fall in the price of copper has checked speculation in the mines dependent upon that metal market, but no harm has been done. Tin is still going strong, justifying the larger dealings in tin shares, especially those of the Malayan peninsula. Zinc and lead maintain a high level, and no reason exists why they should not do so. Hence the Broken Hill group is well supported. Whenever terms of agreement are finally reached by Turkey and the Allies, eliminating further fear of international complications, a decided revival of activity in the mining markets is assured.

TRANSVAAL.—The production of gold in the Transvaal for December was 776,406 oz. valued at £3,297,962; of this 745,860 oz. came from the Rand and 30,546 oz. from outside districts. The figures for the year 1912 were: Rand 8,753,563 oz., outside districts 370,731 oz., total 9,124,299 oz. worth £38,757,560. The value of the total output in 1911 was £34,991,620. The labour figures for Novem-

ber showed an increase of 4823, and for December a further increase of 4435.

The total of dividends paid by the mines of the Transvaal in 1912 is £8,217,417, as against £8,066,637 in 1911. On the other hand the so-called profits aggregate £13,000,000, as against £11,415,000 in 1911. Therefore the proportion of 'profit' distributed was 70% in 1911 and 64 $\frac{3}{4}$ % in 1912. The gain in dividends is satisfactory, but the further diminution in the proportion of profit that gets into the pockets of shareholders must not be overlooked. The companies to pay a maiden dividend are the Bantjes, Brakpan, City Deep, Modderfontein B, Randfontein Central, Randfontein Estates, and Sub-Nigel. Twelve companies have increased their annual dividend, which, with the seven maiden dividends, makes 19 gains. On the other hand, 8 companies maintain their rate of dividend, while 16 have made a reduction. Of the big consolidations, the Crown Mines pays the same dividend as in 1911, but the East Rand Proprietary pays 5% less. Among the older mines the biggest increase is the advance of 20% scored by the Meyer & Charlton, while the most remarkable contribution is the maiden dividend of 40% (amounting to £300,000) paid by the Brakpan. The biggest aggregate of dividends is the £1,034,116 paid by the Crown Mines. This represents 110% on the capital and 15% on the share-value of the property. The Robinson pays £618,750, which is at the rate of 22 $\frac{3}{4}$ % on the capital and about 32% on the market valuation. The East Rand Proprietary pays £611,474, which is 25% on the capital and about 9% on the market valuation. These wide differences in the yield as measured against share-prices are explained by the fact that the lives of the three mines mentioned are estimated at 40, 6, and 25 years respectively.

The total dividends of companies operating on the Rand, not the whole Transvaal, shows a gain of £251,545, to £8,014,631. The dividends represent 6s. 5d. per ton of ore milled, as against the 9s. 11d. per ton of average working profit. In other words, the 'working profits' are 54% greater than the dividends.

The fine performance of the Brakpan has enabled the Consolidated Mines Selection to declare a 10% dividend for the past year. We are particularly pleased to record this improvement in the fortunes of the Consolidated Mines Selection company, for it is one that has always done clean business.

Sir George Albu, one of the soundest and safest of advisors on Rand affairs, expressed the opinion, at the Van Ryn meeting, that South African mining is undergoing a recovery from two years of depression, due largely to a disorganized supply of labour.

That splendid mine, the Meyer & Charlton, made an increase of £18,547 in its profits for December, due entirely to a decrease of 9d. per ton in expenditure. We note that the General Mining group made a fine showing in the last month of 1912.

The Randfontein Central made a gross profit of £883,000, but a real profit of only £578,000, which is 65% of the gross. The difference went to debenture interest, profits tax, water and phthisis assessments, rates, taxes, claim licences and lease rents. These are all as integral a part of the expenses of mining on the Rand as the money spent on labour, dynamite, candles, and fuse.

Scarcity of labour is still a hindrance. The Main Reef West is crushing less than 18,000 tons monthly, as against a mill capacity of 20,000. This is explained by the lack of native labour. Nevertheless the 20 stamps are being added to the mill, bringing its capacity to 30,000 tons monthly. On the face of it, this is an unintelligible policy.

The New Modderfontein increased its monthly profit, in December, by £14,000. It

is stated officially that a "large number of stope faces gave unusually high values," but a comparison of statistics shows that the gain is due partly to an increase of 2500 in the tonnage crushed.

WEST AFRICA.—The Chamber of Mines gives the November output of gold as 33,183 ounces, valued at £137,700, a slight decline as compared with October, but exceeded only by that month and September. Among the mines exhibiting an increased production are the Ab-bontiakoon and Broomassie, while the Bibiani and Prestea show serious decreases. The Ashanti Goldfields maintains the premier position. The Prestea figures suffer temporarily by the inclusion of development redemption in the total cost. This is a notable addition to the list of companies trying to give correct data to their shareholders.

We refer elsewhere to the Rayfield. The extension of the railway from Rahamma to Bukeru will pass within two miles of Top, where this mine is situated. The systematic testing of the alluvial ground on the Shen claims is to be taken in hand vigorously; this work was started with a drill borrowed from the South Bukeru Company; when the drill was required by its owners, the drilling had to be stopped. As far as it went, it showed about 2½ lb. cassiterite per cubic yard. Among the recent additions to the mineral collection at the Rayfield company's London office is a unique piece of crystallized cassiterite. It is not water-worn, for the ground from which it came is really more an unsorted detritus or scattered talus than a true fluvial alluvium. In thickness the deposit ranges from nothing to 14 feet; it lies along the bed and upon the steep sides of a narrow stream, which, in the rainy season, becomes temporarily torrential. Although the deposit is richest in the river-bed, yielding as much as 11 lb. cassiterite per yard, it extends laterally for as much as half-a-mile.

The Broomassie dividend, at 10%, is an encouraging event. The working cost has been

reduced from 47s. 8d. to 31s. 11d. per ton, excluding development redemption at 10s. 4d. per ton and several other items. This large allowance for development is due to the fact that the orebody, which is short and rich, is pitching away from the shaft, so as to necessitate at least 600 feet of driving before the level reaches the ore. The actual total cost is 52s. 8d., which it is expected to reduce, but the difference between the working cost and the total cost must be emphasized. The reserve of ore is given at 44,000 tons, averaging 23 dwt. per ton.

Offin River shares have risen, not on earnings from dredging in the Gold Coast colony, but in the expectation of benefits to accrue from this company's tin areas in Nigeria. As the Offin River Gold Estates is heavily capitalized, the winnings from tin will have to be large in order to benefit shareholders.

The Asiakwa Trust, with a capital of £7,000, has a working option on 3,200 acres of alluvial ground belonging to the Eastern Akkim company. A hydraulic plant is now being erected under the direction of Mr. John Saxton, who has had experience in Borneo and Australia. A part of the area has been tested by ground-sluicing, with results leading to the present operations.

A mining engineer writes to us saying that the "Gold Coast is a health resort compared to what it used to be." This is a tribute to the efforts of the mining companies, which, until lately, have received but little help from the Colonial government. The improvement has come by attention to clearing the jungle, draining the swampy ground, and the use of cold storage for preserving food.

At the meeting of the Himan Concessions, Mr. W. T. Trevenen, the chairman, gave some interesting information concerning the Anfar-gah, which is being developed satisfactorily. On one lode, at a depth of 218 feet, an average assay of 64s. per ton for a width of 28 inches and a length of 770 feet is recorded. On an-

other lode an average of 85s. per ton has been obtained for a width of 80 inches and a length of 131 feet. At other points some good assays have been obtained, down to 255 feet. These figures, with confirmatory details, were also given by Mr. Scott Lings, as chairman of the West African Trust. He also spoke favourably of the Sefwi Goldfields, where an ore-shoot about 1200 feet long has been proved.

The chairman of the Kano Tin Areas should become better informed on technical matters. He said: "Some tin won from this lode has also assayed between 64½% and 71½% metallic tin concentrate." He meant, but came far from saying, that some of the ore yielded a concentrate containing about 68% tin. The idea of dredging has been abandoned on account of insufficient water. We await the report of the company's engineer, Mr. H. E. Nicholls, with interest. The Jos is able to distribute a 10% dividend, out of earnings amounting to £10,000. The output for the year was 161½ tons of concentrate averaging between 74 and 75% tin. The cost at the mine was £18 per ton of concentrate, but the total cost was £65 per ton. A bucket-dredge is being built and is expected to start work during the next wet season. We note that at this meeting the chairman, Mr. Assheton Lever, referred to the friendly attitude of the Colonial Office and to the further extension of the railway.

RHODESIA.—The November output of gold is given as 53,667 ounces, worth £225,957. This is a decrease of 999 ounces as compared with October and is largely due to the shorter month. However, it is the lowest production since April. The Giant and Selukwe-Columbia are the only companies showing a serious decrease, while the gains are all small.

The Amalgamated Properties of Rhodesia had a much pleasanter meeting than last year. The shareholders seemed less restive. One incident is worthy of comment, and that is the exposure by the chairman, Mr. G. R. Bonnard, of the anonymous letters of a bogus shareholder.

It appeared that a financial paper had published a serious charge against the board from somebody writing over a pseudonym. No paper deserving public confidence should publish anything from a correspondent who either is anonymous or claims to be what he is not. We only wonder why the directors did not take legal action for libel.

The Beatrice mine, acquired by the General Mining group in 1910, but a disappointment at first, is now said to be promising. The workings, which are down to 820 feet, disclose five ore-shoots, yielding fair assays in gold.

The Giant mine has suffered from a subsidence affecting pillars of ground above the No. 6 level, but the main shaft has escaped injury. This mishap, on top of the failure to find the faulted orebody, has depressed the shares.

MEXICO.—We stated in our last issue that the Grenfell group had taken an option on the La Noria mine, in Zacatecas, for the Camp Bird company. This was an error. The La Noria, it is true, was recently examined for the Esperanza company, which is under the same control as the Camp Bird, but it is the Reforma mine, at Campo Morado, in Guerrero, that is now being examined with a view to a Camp Bird issue in which French and American capital will participate. As far as we know, no decision has been reached in regard to the purchase of this mine. It has been a notable producer of gold, silver, and copper, but the rich ore has mostly been removed, leaving the low-grade material to be concentrated and smelted. The property contains not one orebody but many. The Reforma was carefully examined by Mr. R. M. Raymond, for the Exploration company, three years ago, but the protracted negotiations at that time did not result in business. The mine is a big one, with good prospects; it has large reserves of low-grade ore, which, to be rendered profitable, require an expensive plant and the extension of the Mexican Central railway from the Balsas river to Campo Morado.

We published an article on this mine by C. S. Thomas in our issue of July 1911.

The Tomnil mine is shut-down owing, it is said, to political disturbances and demands for higher wages. The chairman mentioned the pilfering of rich ore as the chief risk during a period of idleness, from which it would appear that adequate protection is not obtainable.

Among the mining companies troubled by the state of disorder in the outlying parts of Mexico is the Avino Mines, whose property is in Durango. This was seized by a party of 250 bandits, who destroyed the company's warehouse. The mine was shut-down, but the arrival of Government troops has enabled the manager to re-start the pumps and prepare for a general resumption of operations.

UNITED STATES.—The increase of copper metal in stock has depressed that market, but a temporary depression will do no harm. It is better than a big rise, which might stimulate the use of substitutes, such as aluminium and its alloys. The most notable event of 1912 was the purchase of the Live Oak mine by Mr. John D. Ryan and his associates of the Amalgamated, and the subsequent consolidation of the Live Oak with the Inspiration. This mine contains a large body of 1'95% copper ore, which must be mined underground. It is a neighbour of the Miami, in Arizona. Two or three years must elapse before production can begin. The Ray Consolidated has not made the output anticipated, on account of difficulties in mining a flat orebody. Another noteworthy event in the past year was the decision, at last, of the Arizona Copper Company to abandon its "animated scrap-heap," as the old plant is locally known, and replace it with a modern equipment designed by Mr. L. D. Ricketts. The Miami is doing well, having increased its mill capacity to 3000 tons, with arrangements for a further expansion to 4500 tons of ore daily. The Chino, in New Mexico, has exceeded even the expectations of its promoters. The Nevada

Consolidated is opening-up a new orebody west of the Copper Flat workings. This big mine and the Utah Copper have both maintained a maximum production. A lot of stripping is needed at the Utah before a further increase of output is practicable. On the whole, these large masses of disseminated copper ore have fulfilled reasonable expectations.

CANADA.—The production of gold from Porcupine in 1912 is estimated at \$1,800,000. Nearly all of this was yielded by the Hollinger and Dome mines. A long letter attacking the

plans were shown, and other information given, was in violent contrast with the secrecy manifested at the Dome mine.

RUSSIA.—The Orsk Goldfields has ended its productive season, from May to November, during which period the dredge on the Kolchan placer dug 382,550 cubic yards, yielding gold worth £25,473; while the stacker-scow at Pokrovsky raised 18,685 cubic yards, yielding £11,826 in gold. Thus the total was 451,235 yards, yielding £37,299. Working costs of 3½d. for the dredge and 13¼d. for the stacker-



THE MIAMI MINE: SHAFT-HOUSE AND ORE-BINS.

Hollinger report appeared in one of the financial papers, but it abounded in elementary errors and was signed by a gentleman whose claim to be taken seriously was discounted by his signing himself a Fellow of the Geological Society of Australia, a Member of the Victoria Chamber of Mines, and a Member of the American Mining Congress. On the other hand, we are informed that developments on the third level are highly encouraging. We are glad to testify that Mr. Percy A. Robbins and his staff impressed the present writer most favourably when making a visit to the mine last March. The frankness with which assay-

scow are excellent, but these can have only an academic interest to the shareholders until the expenses of royalty, administration, and winter maintenance are known. They may not be ascertainable exactly until the end of the financial year, but an estimate should have been given with the summary of the operations, for without this information the other figures are illusory. We have reason to believe that the royalty is £5000 per annum, that the administrative expenses are about £20,000, and to this must be added the costs of construction. The total of these general expenses is big enough to render the operating cost an unsafe guide

as to the profit accruing to the shareholders. The cost of administration is just as integral a part of the expense incidental to mining as the stoping of ore and the digging of gravel.

The Pioneer Company of Siberia has been unsuccessful in its first year of prospecting on the Amur and Amgun rivers. A sum of £27,500 has been spent in necessary expenses. We learn, however, that Mr. Ross Hoffmann, the engineer in charge, under the guidance of Mr. C. W. Purington, has found a promising dredging area, which is now being tested.

At the Spassky the bottom level, at 560 feet, has cut into the orebody westward a little sooner than expected. The ore assays 13% copper.

The Bogoslovsk Smelting Co. in Perm has placed an order for a Murex plant of 25 tons capacity, for the experimental treatment of low-grade copper ore, containing pyrite, chalcopyrite, and pyrrhotite, with garnet. In addition, an electrolytic refinery is to be added; its capacity will be 1600 tons per year, to be increased eventually to 2500 tons.

The Kyshtim continues to grow. From the latest figures it is apparent that the Amerikansky orebody, east of the Karabas smelter, is an important asset. Seven bore-holes have tested this orebody, so that Mr. R. Gilman Brown is able to estimate that 296,000 tons of 31½% copper ore have been proved. The total reserve in the four mines is now estimated at 1,819,000 tons, with 550,000 more tons regarded as probable. For 1913 the output is expected to be 365,000 to 380,000 tons of ore, yielding 7600 to 8000 tons of copper.

It should be good news to shareholders of the Lena Goldfields that Mr. Leon Perret has been appointed resident manager of that big alluvial mine at a salary of £6000 per annum. He should be worth it. A Russian by birth, although of French extraction, he is an engineer of wide experience, having studied alluvial mining in New Zealand, Australia, and California. Recently he was manager of the

Shouvaloff platinum mines in the Ural mountains, where he did excellent work. If the gravel deposits of the Lena Goldfields have not been irretrievably gutted, Mr. Perret ought to improve the prospects of the company, for he is far too sensible to have undertaken the management without an agreement giving him a free hand.

AUSTRALASIA.—Great Cobar did much better in 1912 than in the preceding 18 months, the profit of £168,617 last year comparing with £102,354 in the earlier period. The position is decidedly more cheerful as regards the ordinary shareholder. Of the underwriting commission only £50,000 remains to be written off, and with the doubled plant, it is not unlikely that the increased yield will suffice to earn a profit of £240,000, which is the amount required to pay 10% on the ordinary shares. The new concentration and flotation plant has been started, after many vexatious delays, due to insufficient labour and slow delivery of machinery. Labour conditions are now much improved. Mr. H. C. Bellinger, the manager, is expected in London next month. He will, we hope, have a chance to address the shareholders. During Mr. Bellinger's absence the local management will be under the direction of Mr. F. Danvers Power.

Mr. C. S. Herzig has just returned from an independent investigation of the Great Cobar.

At Broken Hill, local gossip indicates that the South mine has the largest potentialities of any mine in the district. The North is rated a good second. The South Blocks, belonging to the Zinc Corporation, has cut 60 feet of ore close to the boundary of the South property; this width compares with 14 or 15 feet in other parts of the same mine. The British mine provokes divided opinions. This may be due to the refusal of the management to allow an inspection of the underground workings and the apparent indifference to public criticism. Some claim that Mr. G. C. Klug's estimate of the tonnage available is

too big, others say that the grade of the new orebody has been placed too high.

A rise in Great Fingall shares is not due to any special news, so we presume it is caused either by anticipations of the earnings to be won from the new orebody in the bottom of the mine, or else it is due to ordinary market manipulation. The main winze or new "internal shaft" from the 13th level will not reach the 18th for about five months. On the bottom level the orebody is 500 feet long, assaying about 10 dwt. gold for an average of about $5\frac{1}{2}$ feet.

At the Sons of Gwalia a change of superintendent has been made. Mr. John McDermott is succeeded by Mr. Alfred Wauchope. Developments in the bottom of the mine are excellent, down to the 19th level. Shaft-sinking to the 20th level will begin in February.

INDIA.—The output of the Indian mines is still reported in bullion ounces. The total for 1912 was 584,838 ounces, which, at £3. 18s. per ounce, may be valued at £2,265,000. This is the highest on record, but the previous best, in 1905, was not much lower. After that year, the decrease in the yield at Champion Reef caused a slight fall in the total figure, but this loss is now made good by increased yields at other mines and by the entry of the Anantapur goldfield into the list of producers. The oldest of all the Kolar group, the Mysore, continues to enjoy unbroken prosperity. The latest reports show that in Tennant's section the ore disclosed on the lowest levels averages 30 dwt. over 5 feet, and that the reserve is four years ahead of the mill. The Oregum has not done quite so well this year, but the reduction in the cost will amply compensate for the diminution in content. The success of the Anantapur district is an important feature of Indian gold mining in 1912, for these deposits are undoubtedly of great promise. Improved cyanide plant has been started in the Kolar district during the year, though the margin left after amalgamation

does not give much scope for increase in extraction.

VARIOUS.—All the tin mines on the Malayan peninsula are being boomed on the improved prospects due to the rise in the metal. The Siamese Tin shares have been conspicuous owing to a recent spurt, for which no specific



Gold-bearing alluvial bottom in Siberia

reason is apparent. A rise of £60 in the price of tin, as compared with the high quotation of a few years ago, is enough to warrant renewed optimism among operators, for it permits the re-treatment of residues and the utilization of low-grade material previously unprofitable.

A cablegram from the Oroville Dredging company's office at San Francisco announces the starting of the dredge on the Pato concession in Colombia on December 24.

EDITORIAL

TRADING RETURNS exhibit the prosperity of the United Kingdom. In 1912 the total of imports reached £744,896,514, which is the highest on record. Exports and re-exports increased by 7.3 and 8.8% respectively. Evidently our people are making money.

DESPITE the fact that the postal rate on letters from the United States to England was reduced to 1 penny, or 2 cents, per ounce five years ago, we still receive numerous letters from America stamped at the old rate of 5 cents per half-ounce.

REPORTS from Cobalt contain statements concerning fabulously rich ore. Such statements, while true, must be taken with a due regard for the fact that the ore exists in thin veins or veinlets of calcite full of native silver and silver sulphide. An assay of four or five thousand ounces of silver will not cause disproportionate excitement if it is remembered that the vein is, for example, one inch wide.

THE LONG ARM of coincidence was never more sadly illustrated than in the article by T. Lane Carter, to which we give posthumous publication in this issue. It will be seen that he refers to the need for care in exploring old workings, apropos of a fall that proved nearly fatal to him in some ancient diggings in Rhodesia. As our readers are aware, he lost his life last July by falling into an old stope, while engaged in sampling the Polaris mine, in Montana.

VARIOUS methods of publicity are available. We find that a supposedly reputable paper, *The Standard*, is soliciting members of the mining profession for an article

"the details of which" are "to centre round" the particular individual or firm that pays the price. One of our friends apparently succumbed to this pitiful puffing scheme, for a laudatory article, circling around him, appeared in a recent issue of *The Standard*.

THE EFFORT to investigate the so-called money trust in America may not be successful in eliciting facts, but it has served to show that Mr. J. P. Morgan and his associated group of enterprising financiers do not hesitate to make faces at the American government and the American people. We have never read any testimony more impertinently false on the face of it than that given by Mr. Morgan when under cross-examination by Mr. Samuel Untermyer. It amounted to telling the commission of inquiry, authorized by Congress, to go to the devil.

ACCORDING TO the statistics of the Board of Trade, the total of new undertakings issued during 1912 comes to 666, involving capital to the amount of £236,712,000, as against 704 issues, representing £250,174,000, during 1911. Thus the decrease is small, and all of it occurred in the first half of the year. But the flotations of the past 12 months compare poorly with those of 1910, in which year no less than 948 issues, absorbing £362,408,400, were made. That was high-water mark. It was a spring tide in financial enterprise. As regards mining, the statistical record reflects faithfully the dullness of the markets, for in 1912 only 55 issues, requiring £4,862,900, appeared, as against 72 new issues, taking £11,046,200 in 1911. The mining flotations of 1912 are the smallest in number and capital since 1907, which was a year of exceptional trade activity.

WE UNDERSTAND that the Camborne School of Mines is seriously embarrassed by lack of funds. The Government is unwilling to make a grant because no precedent exists for doing so. The school does not come under the University Act, for its complimentary connection with the Victoria University, at Manchester, is not deemed sufficient to bring it within the benefits of that Act. The County Council is unable to help the school. The position is serious. We regard it as disgraceful that the Cornish mining school should be starved for a little money, when it is remembered how much wealth has been gained to the world in general, and to the British in particular, by means of the inherited skill of the Cornish miner. If only one among the many that have won fortunes by the aid of mine captains from the old county would now make suitable recognition of what the Cousin Jack did for him, the mining school would be placed on its feet. The amount required is not large. The school is well worthy of support. Among the students are young men from every quarter of the globe. The teaching is earnest. The school is well placed among mines illustrating a variety of method. It is painful to think of the paltry recognition given by the Government to the education of mining engineers in an Empire that is the direct result of mining exploration and mineral development.

THE DECEMBER MEETING of the Institution of Mining and Metallurgy was devoted to the discussion of three papers on tin. An interesting introduction by Mr. George T. Holloway suffered by being too non-committal. This was remedied by Mr. Hugh F. K. Picard, whose criticism was just what it ought to have been: penetrating but polite. Incidentally it is worthy of remark that really good papers do not provoke discussion. Such was the paper submitted by Messrs. W. J. Sharwood and A. J. Clark

on the metallurgy of the Homestake. This received wholly inadequate recognition in the way of discussion. It might be well if members of council recognized that among their obligations was to prepare suitable comment on such important expositions of technology and not leave it to the chance moments on a train or in a taxi-cab to put together their random remarks. This does not apply to the December meeting, at which the contributions to discussion were both large in number and high in quality. Poor papers stir the combative and controversial powers of an audience to a degree highly beneficial in so far as they tend to balance the inadequate treatment of any subject by supplementing a paper with a discursive and illuminating discussion.

THE PRODUCTION OF TIN in Cornwall during the past year has shown a slight increase, if we may judge by the amount of black tin sold at the fortnightly ticketings. The actual figure was 6492 tons, as compared with 6151 tons during 1911. The high price of the metal has proved, however, a greater boon to the old county than the increase in the output. The sales brought £831,908 as compared with £702,587, and the average price per ton was £128 as compared with £114. Of the individual mines, the most notable advances have been shown by Carn Brea & Tincroft, and by the Grenville. The former returned 932 tons as compared with 776 tons, and the latter 748 tons as compared with 594 tons. Dolcoath sold 1616 tons in 1912 and 1699 tons in 1911, the fall being due largely to the floods early in the year. In studying these statistics, it should be remembered that the Wheal Kitty and the Geevor have recently dropped out of the ticketings, as also has one of the tin-streamers, the produce of these three ventures being now sold by private contract. On the other hand, the Fal-mouth Consolidated has made the reverse al-

teration, and since May has offered the Wheel Jane concentrate at the ticketings. The brightest and most hopeful feature of Cornish mining is the serious movement toward perfecting the extraction of the cassiterite. Of this we write elsewhere in this issue, in connection with the discussion at the recent meeting of the Institution.

1912 1913.

The periodicity of this publication is not fixed by the revolution of the earth round the sun but by that of the moon around the earth. We review mining affairs monthly; therefore it is not customary for us to lay stress on the passing of the calendar year. Nothing is so dead as the past. Yet a look backward is inevitable, if only in deference to general sentiment. The year 1912 has emphasized the fact that while the means of communication, by wire and by wireless, has expanded the commerce and accelerated the business of the world, it has concurrently enlarged the area of perturbation whenever anything goes wrong in the complex mechanism of civilization. Wars and rumours of wars have repeatedly frozen the swift currents of speculation and paralysed the free movements of business. The wars in Tripoli and the Balkans, the revolutions in China, Nicaragua, and Mexico have thrown their shadows across the map, but these would have terrified the cautious man of affairs far less if they had not been crossed by the fainter but bigger shadows of an impending European war greater than any as yet recorded. This fear of a general embroilment of the Great Powers has loomed in the background, intimidating the bourses and unnerving the markets of the world. We refuse to believe in such a cataclysm; on the contrary, the general recognition of the immensity of such a disaster is the best assurance that it will be obviated. Fortunately the principal mining regions of the present day are not within the area directly affected by the wars of 1912, although the re-

volution in Mexico has crippled operations in a mineral region of the first rank. In Nicaragua and in Serbia, some mines of interest to English shareholders have suffered. The effect of war has been not so much at the mines themselves as at the fountains of capital, which irrigates the waste places of the earth and renders them fruitful to industry. When credit is shaken, it is difficult to raise money for new adventures. For this reason the flotations of 1912 have been restricted, particularly as regards mining. It is true the public responded eagerly to the allurements of Northern Nigeria when a tin boom was incubated in the early part of the year, but the promoters did not give the public a fair run for their money, and the excitement culminated in a fiasco that injured not only the prospects of Nigeria but the entire mining market. Indeed, the Anglo-Continental and the East Rand scandals are among the outstanding events of the year. However, the fact that these episodes were deemed disgraceful is a sign at least that such performances are now considered abnormal. As against the one, we have real progress and increased production in the tin districts of Nigeria; as against the other, we have the successful and highly important developments in the mines of the Far East Rand.

On the whole, looking back on the year just closed, we are inclined to consider that, from a mining point of view, the most encouraging feature is the awakening of the conscience of the company administrator and his dawning recognition of the rights of the minority shareholder. In 1913, as in 1912, we shall continue to hammer at the idea, essential to the good health of the mining industry, that directors are trustees for the shareholders, who are the owners of the mines. We shall do our best to impede irregularities of administration, to check wrong-doing, and to make it unprofitable; on the other hand we shall do what we can to encourage those who are try-

ing to give the public a square deal ; we shall stand by the honourable engineer, and encourage the conscientious director. We hope, more and more, to receive the support of, and cooperate with, all those who look upon mining not as a tricky game but as a legitimate industry.

Rayfield.

The Rayfield pays another interim dividend of 10% for the last quarter of the year. This is an appropriate sequel to the encouraging annual report given by the manager, Mr. J. M. Iles. His estimate is that 5500 tons of tin are assured, and that the annual yield will be 720 tons of a 70% concentrate to be mined at a cost not to exceed £20 per ton. But this is only the cost on the ground ; to it must be added sundry expenses, which more than treble the figure, before any deduction can be made as to the ultimate profit available for dividends. The other items of cost necessary to an intelligible estimate are not withheld purposely ; the silence on that point is in accord with current official practice, whereby shareholders are frequently, and unintentionally, misled. Mr. Iles himself is probably the most competent, and certainly the most successful, mine manager in Nigeria. We are satisfied that he is willing to give information frankly. On mentioning the matter to him he gave us the following additional details :

Mining 60 tons of concentrate at £20 per ton....	£1200
Freight on 60 tons at £22. 10s.....	1350
Royalty at 5%.....	430
Development.....	100
London charges, travelling expenses, etc.....	125
Smelting charges on 60 tons.....	540

£3745

These figures are based on a monthly production of 60 tons of concentrate containing 70% metallic tin. The royalty, which is based on a price of £200 per ton for the metal, is shared equally by the Colonial Government and the Royal Niger Company. It will be seen that

the total charges amount to £62. 8s. per ton of concentrate. Mr. Iles places it at about £65 per ton of 70% concentrate, or about £93 per ton of metal. Given this figure, the tonnage monthly, and the market price of tin, any shareholder can readily see what his earnings are likely to be. Obviously the hiatus between an operating cost of £20 per ton and an ultimate expense of £65 per ton leaves plenty of room for misunderstanding. Even then it is better to write and talk in terms of metallic tin, quoted daily, than in terms of a concentrate, of variable contents. We lay stress on this matter because we feel assured that Mr. Oliver Wethered and his associates are desirous of treating their fellow-shareholders fairly in regard to the explicitness of the information emanating from the company's office, and they will be perfectly willing to accept our suggestion that the cost should be stated in terms that include all the expenditures incidental to mining operations as conducted by a company in London.

Globe & Phœnix.

The shareholders in this company have received a circular expressing the unrest of a number of their co-proprietors in Scotland. The unrest is due, so it is asserted in the circular, to the bad management of the company's affairs. We have read the circular. It is well written and asserts the rights of shareholders with a vigour and cogency unusual in such documents. In brief, the signatories object to the restriction of production, and impute that restriction to the fact that the directors receive, besides their fees, a bonus of 5% on the dividends. If the latter were increased rapidly, the directors would receive so large a sum as to constitute a scandal. Last year the 7 directors divided £16,800 between them. This to us does not seem too much if they gave their best time and ability to the administration of the company's business. Meanwhile, it is claimed by the recalcitrants that

the mine should be worked for the present proprietors and not for posterity. They insist that the directors are really receiving 5% on the capital, for the property is "a depleting asset." This is true. There is said to be a lot of rich ore in the mine. They do not want it to be preserved for the benefit of "future shareholders:" on the contrary, they insist that it shall be extracted without unreasonable, and uneconomic, delay. To this the directors murmur something about "picking out the eyes of the mine," but the Scotsmen are too canny to be bluffed: they reply in good Latin that they want the gold *quam primum*. It is a pretty quarrel. In order to get their way, they ask their fellow-shareholders to join with them in requisitioning an extraordinary general meeting, to elect two directors sworn to their cause, and three more at the next annual meeting, when three of the old directors retire in rotation, thereby gaining the power to change the policy of the company according to their own notions. It is stated in the circular that the production has varied unnecessarily, that capital expenditure was incurred inopportunistically, that the declaration of the dividend was postponed for reasons that were spurious, that the share-quotations fell in consequence, and finally, that the shares have been depreciated "with a view to the acquisition of enough of them by themselves [the directors] or their friends as would enable them to re-acquire the control," which is said to be endangered by a large addition of new shareholders. As to this, no proof is given. Nor do we see any evidence of the idea that the mine contains much more rich ore than is officially acknowledged. Such suppositions may be gratifying to minority shareholders, but we trust that they will not be taken as gospel by those not yet shareholders. On the other hand, the complaints of "meagre information" are justified, as we know. That is one reason why statements without sufficient detail concerning ore in reserve have incited the suspicions that rich ore

is being hidden. The consulting engineer's estimates have been given with a misleading precision in some respects, and with a bewildering obscurity in others. No satisfactory explanation has been published for the proposal to spend £80,000 in sinking a new main shaft. These and other items of policy may be justifiable, but the apparent disregard of the rights of the minority shareholder cannot be justified. Our sympathies are with Messrs. G. Barbour Turnbull, D. W. Paton, and George A. Porter. We hope these three champions of the down-trodden minority shareholder will succeed in the assertion of their right to be properly informed concerning the administration of their property.

Special Correspondence.

The letters from our special correspondents at various mining centres constitute an important feature of this Magazine. It is known to most of our readers that these letters are written by technical men in close touch with the mining affairs of their particular habitat. In periodic communications they give the sifted gossip of their own locality, an account of technical progress at the mines and smelters of a particular region, and general comment on mining affairs within their cognizance. It is not too much to say that the comment is at least as trustworthy as that appearing in the editorial columns of most of our contemporaries, while the technical data are at least as reliable as the better kind of technical articles published in other papers. With all the opinions expressed by our correspondents we do not agree, nor is it necessary that we should, for reasonable difference of opinion is more interesting than artificial unanimity. Any one of our correspondents may at any time express a local opinion opposed to the views held by the editor, and it is all the more interesting for that reason. In this issue we publish several letters well worthy to rank with the best of current technical writing. Our Johannesburg correspondent, for ex-

ample, is both interesting and humorous in his comments on mines and men in the Transvaal. The paragraph on the sorting of ore is an excellent contribution on a technical subject of prime importance, and his treatment of the after-dinner speech-making manages to be amusing, without being unkind to the postprandial orators of Johannesburg. Our Melbourne correspondent gives a review of mining affairs in Australia. His letter is, in effect, a timely article written by one in close touch with current developments. It will be noted that both the Melbourne and the Kalgoorlie correspondents lay stress on labour troubles, which continue to hinder industrial progress in Australasia. Our San Francisco correspondent gives us a valuable summary of recent progress in dredging, besides technical details concerning the use of basic lining in converters and of oil-fuel in reverberatory furnaces. Our New York, Camborne, and Toronto correspondents, as usual, send an interesting budget of news from places far apart, but all linked to London by participation in the business of mining.

Dredging in Spain.

Attention has been drawn recently to alluvial gold deposits in northwestern Spain, near the Portuguese border. Early in December a telegram from Madrid announced the discovery of a goldfield in the province of Leon. The fact is that several British syndicates have been making investigations for some time past, and the locality has been visited by a number of well-known engineers, including Messrs. Arthur L. Pearse, E. B. Kimball, and W. E. Thorne. But the district, from a mining standpoint, is not at all new; it is hoary with antiquity; indeed, it is one of the most ancient goldfields in the world, and has been described again and again in the literature of the subject, from Pliny and Herodotus, down to Alexander Del Mar. Leon was once a part of Asturias, and Asturias used to pay a tribute of two tons of gold per annum to the Cæsars thirteen cen-

turies ago. This once famous goldfield was elaborately exploited by the Romans, who left plenty of evidence of their ground-slucing operations both in the river-beds and on the hillsides. The extent of the gold-bearing ground is large, but the distribution of the gold remains yet to be determined, despite some positive statements to the contrary. On one of the rivers, the Sil, three dredges have been spasmodically at work. One was destroyed by a freshet, but the two others, built by Werf Conrad and Fraser & Chalmers, respectively, are about to be started, with a view more to testing the character of the ground than of earning a steady revenue. To that end it will be necessary to employ several dredges, the building of which will only be justified when the alluvium has been systematically tested by drilling. This will be done forthwith, we are informed, not only in the valley of the Sil, but in the alluvial flats of the Duerna, Bernesga, Torio, and Orbigo, all of which are rivers giving signs of gold-bearing gravel. Water is plentiful. Large boulders are infrequent, but patches of clay will hinder washing occasionally. Grade sufficient for hydraulicking is not available generally, so that dredges must be used. Large areas are said to average 9 pence in gold per cubic yard, the thickness of the alluvium being from 20 to 25 feet. These figures are merely illustrative. It remains to state that the gravel is of glacial origin, showing the characteristics of lateral and terminal moraines that, in places, have undergone sorting and concentration by fluvial action. The qualification "in places" is important, we believe, for it is not everywhere that the rivers have crossed the moraines and left a concentrated gold gravel easily accessible to the miner. Where no such concentration has been effected, the glacial drift is not likely to be rich enough for exploitation. A feature similar in its origin characterizes the alluvium found along the eastern slopes of the Andes in South America. The riches won by the Incas

from the gravel deposits, and even the later successful mining of the Spaniards, has too often been succeeded by modern failures due largely to an ignoring of the fundamental fact that glacial drift is rarely exploited at a profit except where later fluvial concentration has been effective. This hint may prove useful to the enterprising gentlemen now preparing to operate along the river-beds of Leon, and it may serve as a warning to the public, which is likely soon to be approached by the promoters of dredging companies formed to exploit these Spanish deposits.

A Poor Game.

One of the most interesting features of the speech made by Lord Harris at the annual meeting of the Consolidated Gold Fields of South Africa was the prominence given to the fact that this big holding company had made nearly as much money by playing the share-market as by real mining. In other words, the profit from share-dealing during the year was about £200,000, as against a decline of £200,000 in the earnings from this company's mines on the Rand. All the dividends received from its entire ownership of mines in various regions came only to £350,000. This frank disclosure is deeply significant. It means that a financial company controlling the administration of a highly important group of mines could gain as much profit from in-and-out buying and selling of its own and other people's shares as it might receive from attending to its more legitimate business. It may be objected that dealing in shares is as legitimate as the operation of mines themselves, and that both are essential to the business of such a company as the Consolidated Gold Fields. We think not. On the contrary, we consider that the administrators of mines are placed in such a position of trust and responsibility toward the whole body of shareholders that they can deal in shares only at a risk to their trustworthiness. Of course, it is

plain that those who hold the biggest blocks of shares in a mining company will desire to control its operations; and it is obvious that these big shareholders when in control, whether as individuals or as representatives of another company, cannot be expected to promise neither to sell their shares nor to increase their holding, if circumstances render it necessary to do so in order to protect themselves. Counsels of perfection are futile; it is necessary to be practical. Honesty is the best practice. A square deal is the best kind of business. It may not be desirable to tie directors in perpetuity to their original share-holdings or expect a financial house never to realize upon its assets, but it is quite a different matter when one or the other uses the control of a company in order to facilitate the success of gambling operations on the Exchange. To put it plainly, it is against public policy to allow the persons who are buying and selling shares to control the management of the mines, to regulate the publication of news from those mines, and to have first access to the very information on which the market quotation rises or falls. It is foolish for the public to go to a casino where the croupiers play at the tables. Let the croupiers, for the house, receive the stipulated percentage, but, once that is allowed, let them keep aloof from the game. Otherwise it is poor sport. The chances of the game may render it attractive; but when those chances are adversely controlled by officials, it is silly to play. Leaving this analogy, we say, with the utmost earnestness, that mining speculation in London is suffering from the feature against which we now animadvert, and that unless it is corrected the confidence of the public will be forfeited deservedly. We do not expect the impossible. Are there not examples of a better appreciation of the fitness of things? In this issue, by a happy coincidence, we tell the story of three successful enterprises, each of which shows that abstention from market-dealings is desirable in those who

control; and that it is even profitable to them. We commend these examples. Let those that choose to turn their offices into a glorified bucket-shop continue to make money in that way, but, if they do so, let them have the grace to surrender the control over the operations of the mines that they use as counters for their daily operations on the share-market. Meanwhile, to guard against this most palpable defect in company administration, we suggest that the Board of Trade should be given authority to appoint at least one director on the board of each mining company. That director, so appointed, should require no share-qualification; indeed, he should not be allowed to own, to buy, or to sell a share in the company of which he is a director. He should, preferably, be a veteran mining engineer, able to bring a ripe experience to his task, which would be that of a watch-dog for the minority shareholders. As the Board of Trade already finds it difficult to perform the multifarious duties thrust upon it by Parliament, it would be well if the Institution of Mining and Metallurgy were designated to furnish a list of professional men able and willing to accept this appointment of director at the hands of the Government. The presence of such a man on the board and his authorized right to be completely informed concerning the affairs of the company, and of the actions of the other directors in regard to the company, would check any illegitimate dealings in shares. By illegitimate dealings we mean those that are due to an improper use of the information that comes to a director in his capacity of trustee for the whole body of shareholders. The director appointed by the Board of Trade as a protector of the minority shareholders should be empowered to inform all the shareholders of anything done contrary to their interests, and, for causes duly prescribed, he should even be empowered to call the shareholders in public meeting. Such a man would, in effect, be a professional direc-

tor, not a privileged speculator. Until directors are recognized and paid as professional men, the boards of companies will consist largely of jobbers and their dummies. So long as the administration of mines is in their hands, the confidence of the public will be withheld. In the last resort, the capital for mining in England is found by the long-suffering public, and this is the reason why London is the biggest mining centre in the world. When the public withdraws, the working of mines will be in the hands of individual operators, on whom will fall a burden greater than they can bear. The business will shrivel. It is time to face the facts.

Successful Mining.

In the performance of the self-imposed function of a public critic on mining affairs, we find it necessary, more often than we like, to puncture the careless optimism, which, if unchecked, wrecks serious business enterprise. With all the more pleasure, therefore, we turn when opportunity offers, to the contemplation of such successes in mining as prove that there may be castles in Spain and romance in a board-room. At the Ashanti Goldfields meeting, for example, the chairman of the premier West African gold-mining company was able to look back on the 15 years of that enterprise with justifiable gratification. The original shareholders consisted of the late Frederick Gordon and his friends, together with the nominees of the vendor company. This little band of adventurers in the Gold Coast has grown to 5010 registered proprietors. The region had been known as a source of gold for three hundred years, and for a time practically the whole of the European supply of the metal came from that quarter of the world. Much of the gold was derived from alluvial deposits, but an important part was extracted from the soft oxidized ore found along the outcrops of veins. The Ashanti country is so honeycombed with pot-holes, 20

to 30 ft. deep, that it is dangerous for a stranger to stray from the roads. Such being the character of the property acquired by the Ashanti Goldfields Corporation, the first work done, in 1897, was to drive adits into the hillsides below the old diggings. The first battery was sectionalized and the stamps weighed only 350 pounds, to facilitate transport. The 5-stamp mill crushed only 250 tons per month, but it gave results that created intense excitement in London, for the yield was 4 oz. per ton. The Stock Exchange and the public were eager to participate, and at one time the £1 share was quoted at £30. In 1900, when additional capital for the expansion of the enterprise was required, the company issued 10,000 shares at £10 each to its own shareholders, and in 1901 a syndicate took 20,000 new shares at £25 each. In 1904 a new mill, with 50 stamps weighing 1250 lb. each, was erected, and almost immediately afterward the supply of free-milling ore began to fail. The orebody was persistent in depth, but it was highly pyritic, and amalgamation proved impracticable. In 1905, Mr. W. R. Feldtmann was commissioned to advise on the metallurgical problem, and also on the exploitation of the ore in depth. The later history of the mine is well known: how Mr. Feldtmann changed the treatment to dry-crushing, roasting, and cyaniding, and developed the orebody in depth, made connection from the Ashanti to the Obuasi mine, and discovered a valuable ore-shoot in the lower levels of the latter. The 50 stamps are now used for sliming the soft oxidized ore from Justice's mine. The total monthly output now averages 13,000 tons, the yield £40,000, and the distributable profit £17,800. Costs continue to be reduced, the decrease last year being 7s. per ton. The yield was 61s. 9d. per ton, the cost 35s. 5d., and the distributable profit 26s. 4d. Up to November 30, 1912, the gold won amounted to £2,640,000, out of which the shareholders have received £934,655 in dividends, and the

Colonial Government £139,734. In closing this brief sketch of the fortunes of the company, we desire to draw attention to the most pleasant feature of all, namely, the detachment of the board from speculative dealings. No director has trafficked in the shares. Even in 1901 the temptation to sell a part of their holdings was manfully withstood by the directors. There have been booms in the shares, of course, but these have not been incited by the board or by anyone connected with the administration. The office of the company is in Bloomsbury, far from the madding crowd of Throgmorton Street, and the absence of breathless messengers and impatient inquirers in the hall and waiting-rooms indicates the calm serenity of legitimate business.

The St. John del Rey gold mine, in Minas Geraes, Brazil, is another venture that reflects credit alike on the board and on the engineering staff. No spectacular dividends have ever been paid, and, indeed, the finances, on more than one occasion, have given anxious moments to the directors and shareholders. But the mine and the company are nevertheless notable, and for more than one reason. As is the case with the Ashanti Goldfields, the controlling group has no other mining interests, and so is able to give undivided attention to the business in hand. Similarly, the shares are not used as gambling counters on the Stock Exchange, and the company is run on strictly commercial lines. The mine has been continuously worked under English control for the best part of a century, 1828 being the original date of introduction here, and the management has been unchanged for over 25 years. Mr. George Chalmers, who devised the new system of exploitation after the collapse of the old workings, is still in charge. The lode shows no sign of impoverishment at 5000 feet vertically, the present depth. The chairman, at the meeting held last month, stated that the orebody on the 17th horizon, 4900 feet below the surface, was 1028 ft. long

and $12\frac{1}{2}$ ft. wide, and that the quality of the ore was maintained. Further sinking is in progress, with the object of opening another 'horizon' at 5200 ft.; of this additional 300 feet of depth, 228 feet had been completed at the date of the meeting. The race for depth between this and the Jupiter and other shafts on the Rand is naturally watched with keen interest. The 130 stamps crush about 190,000 tons per year, and the yield is from 46 to 47 shillings per ton. The shareholders receive profits averaging 7s. per ton of ore, so the cost is approximately 40s. per ton. In analysing the cost and profit, it must be remembered that during the past few years large sums have been spent out of income for the purpose of providing hydro-electric plant, and for other machinery required for exploiting the mine at great depth. Development is a long way ahead of stoping, the reserve being fully 1,000,000 tons. The only fly in the ointment at present is the scarcity of labour, caused by the rival attractions of harbour, railway, and municipal activities, but various schemes are being considered for introducing workmen from abroad. In the meantime the amount of ore raised will suffer some diminution and the metallurgical plant will not be able to work at its full capacity.

In this article of appreciation we are desirous of taking examples from far-separated parts of the world. Having started with West Africa and proceeded thence to South America, we now turn to India, where John Taylor & Sons have been making money for shareholders in the Kolar group of gold mines for 27 years. As with the Ashanti district, so with the Indian mines; the ancient workers had taken toll of the outcrops. English prospectors discovered the old workings at Oorgaum in the Kolar district of Mysore in 1878, and interested General De La Poer Beresford, who was then stationed at Bangalore. Just at this time, there was a boom in London in connection with the Wynaad deposits on the

Malabar coast, and it was hoped to benefit by this boom in floating the Kolar properties. This hope was not realized, and it was not until further work had been done and promising orebodies had been proved that General Beresford and Captain W. Bell McTaggart were able to obtain financial support in London. This event happened in 1880, when the Mysore Gold Mining Company was formed. For five years the results were discouraging, and the goldfield was within an ace of being abandoned in 1885. The only manager in the district in favour of continuing operations was Ben. D. Plummer, of the Nundydroog. He converted Mr. John Taylor to his opinion, and if ever anyone deserved big rewards for their pluck and sagacity in connection with mining surely it was these two. Among the financial supporters of the Indian group the late Sir Charles Tennant deserves special mention, though we are aware that many other investors with names less known to the general public merit equal recognition. The Mysore company commenced to pay dividends in 1886, and has enjoyed continuous prosperity. But as it is only recently that we gave details in connection with this mine, we shall pass to the Champion Reef, its northern neighbour. The property of the Mysore company was so large that in 1889 a part of it was handed to the new company formed for the purpose, and called the Champion Reef. Here again a success was scored; for 15 years the operations and profits continuously expanded. In fact, it was a race between parent and offspring for the premier place among the gold mines of India. But in 1905 there was a check, for at a depth of 2500 ft. the ore became impoverished, and whereas the yield in 1905 was 68s., the figure for 1909 was only 46s. per ton. The dividend distributed in 1905 was at the rate of 35s. per ton, and in 1909 it was only 5s. per ton, owing to this diminution in the yield. During the year ended September 30, 1912, the yield was 44s. per ton, and the dividend

was at the rate of 1.5s. per ton. Though many discoveries of high-grade ore have been made in the lowest levels of the mine, the average tenor of the ore milled has not been raised appreciably during the last few years. On the other hand, the cost has been substantially reduced, especially by the provision of electric power, generated by the Government hydro-electric station at the Cauvery falls. In the early days wood and coal were used, at a price that entailed an economic handicap. The saving due to the new source of power amounts to over 7s. per ton of ore. The chairman at the recent meeting of shareholders was able to announce that the reserves sufficed for two years and that in all parts of the mine the development was well ahead of stoping. An interesting feature is the sinking of the circular vertical shaft, which when first projected three years ago was calculated to cut the lode at a depth of from 3500 to 4000 ft. Subsequent development has shown that the dip of the lode becomes steeper in depth, and it is not possible at the present time to foretell the exact point of intersection. Modifications have, therefore, been made in connection with the application of this shaft. Sinking has been stopped and a main station is being constructed at a depth of 3700 feet. Connection with the workings has been made at the 33rd level, and two other cross cuts are now being driven. The hauling of men and ore will be done by way of these three cross-cuts. The future policy with regard to deeper sinking will be decided when the necessary information is available: the vertical shaft may be sunk deeper, or auxiliary shafts may be found more suitable. Since the beginning of operations, this mine has produced £10,109,300 in gold, from 2,958,674 tons of ore, yielding £3,888,966 in dividends.

We have lingered over these three episodes in modern mining, because the telling of the story is pleasant at a time when the unsavoury features of market manipulation are so promi-

nently before the public. These three are but types of a large number of similar enterprises; honourable to all concerned and profitable to all who participated. Apart from the lavishness of their resources, these mines are remarkable as having been controlled by managements that sought no shady gains by gambling in the shares of their own companies. It is wholly a blunder to suppose that mining is profitable only when allied to risky promotions and unscrupulous share-dealings.

The Knowledge of Tin.

In the old county that has given the world so many practical exponents of the art of mining it is considered a sufficient encomium if a man can be said "to know tin." Indeed, most Cornishmen would be satisfied to have for their epitaph: "He knew tin." The 'knowledge' imputed in this case includes more than a bit of local mineralogy; it assumes a thorough understanding of the various kinds of tinstone, the places of their origin, and the best method of treating them according to accepted methods. A man that knows tin is regarded at Camborne and Redruth as a philosopher. It comes therefore as a real shock to the Cousin Jack when the utlander in London begins to question whether he does know how to treat tin ore, how to ascertain its contents, and how to make money out of the art to which he and his forefathers have been continuously devoted. That the acumen and skill of the gentlemen west of the Tamar is being doubted was made evident last summer when the scientific societies visited Cornwall. The doubt was expressed courteously, and it was rebutted vigorously. Since then the friendly controversy has been maintained in conversation and in the press. Just before the Christmas holidays the whole matter was ventilated first at a public dinner and then at a technical meeting. On the latter occasion three papers on the treatment and assay of tin ores were submitted before the Institution of Mining and

Metallurgy. And with notable success, as regards discussion. The old subject of the discrepancy between the results from tests on a vanning shovel, on the one hand, and those yielded by chemical assay, on the other, was in the ascendant. We say the "old" subject, for it has been thoroughly ventilated many times before. Indeed, Mr. W. Fischer Wilkinson, the author of the paper that revived the discussion, has exposed himself to censure for the incompleteness of his references to earlier papers. He does refer to half-a-dozen, but he omits several more important than any of those quoted, notably the paper on 'Losses in Vanning Tin Ores' by Mr. Richard Pearce, published in the *Engineering and Mining Journal* of January 21, 1904—nine years ago. In that article Mr. Pearce, the acknowledged authority on such matters, showed that the average loss by vanning, as compared with the chemical assay-method of Mr. E.V. Pearce, was 22.55% on a 3% tin ore. Again Mr. J. J. Beringer wrote on the 'Wet Assay of Tin Ores' in the November 1909, issue of *The Mining Magazine*, and Mr. H. W. Hutchin wrote on 'Tin-Dressing' in our issue of April 1910. These references are omitted by Mr. Wilkinson. We mention the matter because it is pertinent to the discussion, and also to lay stress on the point that technical men starting to write on any subject should take pains to ascertain what has already been written on that subject. However, the day is past for anyone to claim accuracy for the vanning-shovel. That implement was useful as a rough check upon an inefficient method of concentration. Before real metallurgical progress could be made it became necessary to employ a more precise means of ascertaining the contents of the ore. With reliance upon the vanning-shovel will go the dependence upon rudimentary methods of ore-dressing. It used to be a familiar retort on the part of our friends at Camborne and Redruth that needless refinement in the assay was ridiculous because it failed to measure the

extraction attainable in practice. In some measure that was true, but the truth of it has been lessened, fortunately, by metallurgical methods more accurate than the vanning-shovel. So let us put it aside, except as a rough and ready means of examining a tin ore with a view to concentration, for we know it now to be no accurate test of efficiency in modern ore-dressing. Another old argument survives, namely, that the ore of each mine must be taken separately, it being dangerous to generalize. This also is a platitude that has served to cover a multitude of metallurgical sins. The character of the ore may vary as between mines, but a plant badly designed or a method poorly applied does not become immune from criticism by the mere repetition of ancient saws and local proverbs. The whole subject has been mildewed by a reactionary conservatism; what is needed is a little scientific fresh air from the outside. That will make even the Cornish 'Riviera' more salubrious. The 'foreign devils' must break into Camborne as they did into Peking.

Among the evidence yielded by the somewhat inconclusive experiments described by Mr. Wilkinson is the fact that 4.2% of the tin was extracted on a Buss table after crushing in the stamp-mill through "a 4-mesh screen." We presume tin is meant, although it is 4.2% of the "values" that is mentioned; and we suppose that a screening of "4-mesh" equals apertures of about $\frac{3}{16}$ inch. The total extraction in the dressing plant was 68%, yet 4.2%, that is, about 6.2% of the total extraction, was made at this early stage of the process, in the form of a concentrate containing 3.2% tin. This product was not improved by further treatment, nor was it marketable. Here we face a basic difficulty in tin metallurgy. A 3.2% concentrate would not find a market. It is too impure, by reason of excessive silica, to be smelted direct. Tin has a marked affinity for silica when in the furnace, so that a minimum of quartz is essential to successful smelting.

A method of concentration by fire, as is done with a copper ore, is impracticable. In Cornwall today a tin concentrate, to find a ready market, must assay above 65% metal, although a slime-concentrate containing about 45% is sold, but at a much lower rate. The ways of the smelter are dark. It is not for us, on this occasion, to penetrate into the mysteries of the craft, but we say frankly that the truth of the matter will not be completely known until the smelter and the mine are one, under a single control, and are able to treat each other with perfect frankness. In the interesting letter from Mr. Edward Walker, appearing elsewhere in this issue, it will be seen that Mr. Wilkinson's experiments are considered valuable in that they give suggestions for the treatment of the middling and tailing on a novel plan, as is now actually being done in the Geevor mill. This may be taken as one of the immediate results of the discussion. Less direct, but no less important, is the ventilation of a musty subject and the promise of further investigation. It remains only to add that the purpose of tin-dressing, as of the metallurgical art in general, is not to extract a maximum percentage of metal but to win a maximum proportion of profit.

Plaintive Shareholders.

For a couple of weeks in December the financial columns of the *Pall Mall Gazette* were darkened by the doldrums of the scribe to whom that department of our energetic evening contemporary is committed. We read them, for we read newspapers not only for things that are happening but for those that are supposed to happen. The second as well as the first influence the public mind. After the financial editor had expressed his own views, he published those of some of his readers, who, like him, were in a slough of despond as regards the business of mining. It appeared to them that "really capable business men" did not care to be the directors

of mining companies, so that the shareholders are at the mercy of "factions or finance houses." The various contributors to the ensuing discussion asserted that "the finance houses are in league with jobbers in the Stock Exchange," that the big operators gain wealth and knighthoods thereby, that many companies are registered so far from London that shareholders are unable to impeach the directorate, the members of which are largely dummies acting for unscrupulous schemers, that newspapers are in their pay and give misleading information for market purposes, that reports are frequently "vague or out of date," that important news "is usually discounted in the market before publication," and that the consulting engineers cannot protect the public because they "hold insecure positions." The editor himself is disconsolate, *tout à fait désolé*, he confesses that "where the remedy lies is not easy to discover," but he attributes some of the damage to "the half-dozen deliberately dishonest journals" and the rest to the undisciplined activities of bogus engineers. Thus he appears to have gone on a fishing expedition and to have caught many denizens of the sea, especially flounders, gudgeons, and the unhappy minnows that play on the margin. His special article on 'Mining Engineers' was a muddlesome effort to attack a flagrant evil, that of inexperienced, incapable, or fraudulent persons posing as full-fledged practitioners. He had a lot to say about the Institution of Mining Engineers, which his readers probably confounded, even if he did not, with the Institution of Mining and Metallurgy. The former holds no position of authority in precious-metal mining, being a federation of societies, mainly concerned with the British coal and iron industries, and as such having only the remotest connection with the speculative mining departments, such as those given to share-dealings in the mines of the Transvaal, Rhodesia, and West Africa, which are the subject of more immediate dis-

discussion. The Institution of Mining Engineers, we say, has no authority or influence whatever in this direction. The *Pall Mall* editor has been grossly misled, and the fact itself proves how little he really knows concerning technical mining affairs. In fact, that is one of the troubles. Those who write on mining developments in the daily press and those who give advice to shareholders in the daily and weekly journals are mere blind leaders of the blind; most of them are as competent to write on aviation or dairy farming as on mining, most of them are helpless commentators echoing the views received from persons interested in market movements. As much harm is done by guileless scribblers as by the hired purveyors of misinformation. How can the public be protected when guidance comes to them from young men in the City who have never seen a mine, when advice is offered to them by journalists who speculate in shares themselves, when their supposed protectors are editors and publishers buying and selling the shares on which they are supposed to express unprejudiced opinions? The plaint of the *Pall Mall* editor and of his contributors is well founded. It is largely true and it is wholly damnatory. Conditions are bad, but they are not nearly so bad as they were formerly. They will be much better when every owner and editor of a financial newspaper foregoes the chance to become rich quickly for the sake of the opportunity to mould public opinion effectively. The business of mining is cleaner than it was because the mining profession is becoming educated to a higher code of conduct and the representatives of the public are learning that on the engineers lies the burden of improving the *moral* of the whole business. The public must learn that the only advice worth having is that of an experienced and reputable engineer, that the shareholders are protected best by companies employing engineers that will give their directors a suitably virile retort

whenever anything crooked or underhand is suggested, and finally that these things will be accomplished by recognizing directors as professional men. Let the guinea-pig and the stool-pigeon go. Select business men having a capacity for administration and some knowledge of actual mining, pay them so that they can afford to devote their energies with singleness of purpose, and then forbid them to gamble in the shares of their own companies.

Professors.

In March Mr. William H. Taft, President of the United States, will become professor of law in Yale university, while Mr. T. Woodrow Wilson, formerly professor of jurisprudence and politics in Princeton university, becomes the President of the United States. These exchanges of occupation exemplify the fact that a professor may be a statesman and that the chief executive of a great nation may be a profound scholar. Whether the presidency or the professorship be the more honoured by the exchange, we cannot deny that our imagination is stirred by the apparent passing of power and patronage on the largest scale to a man recently a university professor, and the concurrent assumption of the humbler duties of a teacher by another man recently the occupant of the chair of supreme executive authority. Americans have a saying: "I would rather be right than President." There are people in the United States who would rather be wrong than Vice-President. There must be others who would prefer to teach than to be either. Again, a homely proverb says that the hand that rocks the cradle rules the world, largely because the same gentle hand may also rule the head of the house. The more obvious truism is that the mind that educates the youth of a country also shapes its destiny. In our own country we have the well known example of Jowett, the Oxford don who trained a number of England's proconsuls of empire, such as Milner

and Curzon. Similarly, Thomas Arnold at Rugby, or Thomas Huxley at South Kensington, by influencing the mental development of the dynamic men of a younger generation, were among the most potent forces in modern life. Such men of master mind and masterful character influence those who in turn play upon the complex strings of worldwide civilization. Every teacher is not an Aristotle or a Gamaliel, but the teaching that for the moment may seem ineffective as the tired waves that scarce a painful inch can gain may in an unsuspected direction be sweeping forward with all the force of an advancing tide. If power be the aim of strong men, we know no form of it so real as that of an inspiring and effective teacher. In the United States that power has been extended in a notable degree by such professors as have been promoted to the presidency of universities, for they have become publicists taking frequent opportunity of addressing the community on current topics. Thus Mr. Woodrow Wilson passed from Princeton university to the governorship of New Jersey, and thence to the headship of the American nation. Other university presidents, like Mr. Benjamin I. Wheeler, of the University of California, have proved that a professor of Greek may also be a statesman. In our own country the professor does not loom so large in public life, yet the names of Oliver Lodge, Henry Roscoe, and James Bryce will serve to remind us that the professor may extend his teaching, even on political matters, far beyond the cloister or the campus.

We did not wish, however, to use a current event as a text for magnifying men already great; we intended rather to speak a word for the humbler members of an honourable profession, for the professor whose voice is not heard beyond the class-room, for a teacher whose influence is restricted by circumstance. We believe that some of these hardly know how good is the work they are doing; it seems a futile ploughing of the sands, a hopeless

watering of the desert, a dreary grind that yields no sharpening of the primal implement of life. To such we give a hearty hand-shake, telling them to be of good courage. They do not labour vainly. No earnest teacher does work fruitlessly. Immediate results may not be apparent, but the seed sown sadly may be blown elsewhere to blossom in a culture or a character that long after the sower is gone will yield an abundant harvest. The shaping of men still remains a nobler and greater deed than the making of things. The teacher is more than the manufacturer. The professor who takes the ductile mind of youth and moulds it to high endeavour has performed one of the great feats of civilization, for what is civilization but the art of living in communities, and what is more essential to that art than the educating or drawing-out of the best faculties latent in the human units of that community? To some these ideas may seem extravagant. To some a professorship is a mere bread and butter dependency. To more than one professor whom we have known, the lectures were a bore and the students a necessary evil. Such men are an incubus on a school or a university. They are a private annoyance and a public nuisance. They should be made impossible. On the other hand, we have in mind the professor who trains successive classes of students to appreciate fundamental principles, to love knowledge for its own sake, to seek truth because it is lovely, and to think straight until it becomes second habit. We think of the professor who cultivates the minds and, less obviously, but no less surely, directs the blossoming of the characters of his pupils. Groups of these go out from the school or university year after year and take his impress with them. They go into life with a bent for good and with a bias for efficiency. To them he has been a guide, philosopher, and friend. To him they owe the main springs of a useful career. Others may get the plaudits of the crowd or the honours

of high office, to him comes the real gratitude of a generation of young men; to him may come the glowing realization of performing a work that is more fundamentally effective than any other to which human energy can be applied. And as for fame, what is the fickle breath of the popular acclaim that comes to the facile conqueror when compared to that of a teacher to whom hundreds of eager workers turn in affectionate remembrance, as men did to Arnold, to Jowett, or to Huxley, to think of him with gratitude and to mention him with a blessing?

Worthies.

We understand that the Bessemer Memorial Committee is in a quandary regarding the names to be selected for adorning the façade of the new School of Mines building. It is intended to place medallions commemorating worthies conspicuous in the historic advancement of the art of mining. Therefore the Committee invites suggestions. We remember a similar request from a committee of the Columbia School of Mines not many years ago, when a new building was ready to adorn the campus of that celebrated technical college. Most people mentioned the names of Agricola and Raymond, but confessed inability to contribute further. As regards our friends at South Kensington, we have to start again with Agricola, a bygone authority on the subject about to be rendered better known by the translation of his book, 'De Re Metallica.' After Agricola comes Schreiber, a Saxon engineer, whose name is interwoven with that of many famous mines in western Europe at the close of the 18th century, and during the beginning of the 19th. Schreiber belongs to a period when the mining engineers of Saxony went even to Cornwall to show our forefathers how to use the pick and gad. Schreiber was the founder of the Ecole des Mines, first established at Moutiers, in Savoy, in 1808. If the gentlemen at South Kensington desire, as

is likely, to recognize the skill and energy of our countrymen in the overseas dominions, they might well select George Lansell as typifying the Australian contribution to the development of mining. George Lansell was the most enterprising of the Bendigo mine-operators, for many years his 180 mine was the deepest gold mine in the world, he introduced the few modern mechanical improvements used in that celebrated district, and he was a man exemplifying that spirit of intelligent adventure to which mining owes its very life. Should the authorities in question also wish to recognize the big share taken by the American miner in the advancement of the art, they might select James D. Hague as typifying the application of science to art, of money to technology, and of honour to business. Dr. Raymond, happily, is still alive and therefore *hors concours*. These four names, Agricola, Schreiber, Lansell, and Hague should stimulate the imagination and excite the emulation of any student entering the portals of the new building on Prince Consort road that contributes the rhythmical drop of the stamp-mill to the *recitativo* at the adjoining college of music. To the foregoing names should be added at least two more, one of which should be a Cornishman; for example, John Taylor, one time treasurer of the Royal Society, who wrote the preface to Humboldt's travels, and was the founder of a mining engineering firm that has long maintained honourable traditions. Another worthy to be remembered is Robert Hunt, a Devonshire man, the Keeper of the Mining Records, one time lecturer on the application of mechanical science to mining, also a promoter of mining education. Among those more closely identified with the business of mining, we mention John Darlington, an engineer creditably connected with several of the biggest mines placed on the London market, and remembered by his juniors as a man who gave dignity to a business too often vaudevillized.

PERSONAL

G. PERCY ASHMORE has returned from Rumana.

R. F. BAYLISS is in Mexico. He will return in February.

H. C. BELLINGER, the manager of the Great Cobar, is on his way to Seattle, and will reach London in February.

E. S. BIRKENRUTH, of the Consolidated Gold Fields, is in Rhodesia.

R. S. BOTSFORD is at Bogoslovsk, in the Government of Perm, Russia.

WALTER BROADBRIDGE is leaving for South America, and expects to be away three months.

C. B. BRODIGAN will lecture on 'Shaft-Sinking' at the Royal School of Mines at 5.15 p.m., on January 27.

R. GILMAN BROWN has returned from Kyshtun.

WONTNER BROWN is manager for the Boma (Nigeria) Tin Company.

J. MORROW CAMPBELL made a short visit to Spain.

P. CLARKE is at Almonte, Canada.

HARTWELL CONDER has been appointed State mining engineer for Tasmania.

C. R. CORNING passed through London on his way from New York to Switzerland.

J. H. CURLE is in Switzerland.

J. CURRIE, superintendent of the Great Fingall, is in London.

FERDINAND DIETZSCH and C. TONKIN have left for South America.

THOMAS A. DOWN was recently in Portugal.

H. S. EDGAR is at Vancouver.

W. A. ELLISON has gone to Nigeria in the employ of the Kuskie (Nigeria) Tin Fields, Ltd.

GEORGE E. FARISH was married on November 28. He is now in British Columbia.

JOHN B. FARISH was recently in California.

O. D. FILLEY, recently at El Oro, Mexico, has gone to Rhodesia.

F. LYNWOOD GARRISON is in Colorado.

R. E. HAZARD, of Medellin, Colombia, is at New York.

J. A. L. HENDERSON has returned to England from Canada, where he has been since August.

C. S. HERZIG has returned from New South Wales.

H. C. HOOVER is expected from the United States.

BERTRAM HUNT goes to the Gold Coast as metallurgist to the Broomassie company.

J. M. HUES, the manager of the Rayfield, is on his way back to Northern Nigeria.

D. C. JACKLING is at the Alaska Gold Mines near Juneau.

J. OWEN JAMES is here from Montreal.

C. B. KINGSTON, of Pearse, Kingston, & Browne, has returned from a holiday in Canada.

W. J. LORING sails for Burma by the *Moldavia* on January 30.

T. M. LOWRY returned to Nigeria by the *Abosso*.

L. J. MAYREIS has left for Russia.

T. G. OLIVER has been appointed inspector of mines for the Northern Territories, Australia.

R. FRANK PEARCE, manager of the tin smelter at Bootle, near Liverpool, was in town last week.

T. A. RICKARD will lecture before the Cambridge School of Mines on January 22.

F. ROBELLAZ was here from Paris for a few days at the beginning of the month.

W. S. ROBINSON, of Lionel Robinson, Clark & Co., sails for Australia on January 30.

C. RUTLEDGE is manager of the Queensland Copper company's mine at Mount Perry.

WALTER SHELLSHEAR has been appointed consulting engineer in London to the New South Wales Government.

E. H. VAUGHAN has gone to Portugal.

JOSEPH L. WALTON has left England for the Sefwi Goldfields, in the Gold Coast Colony.

D'ARCY WEATHERBE has gone from Peru into the Argentine. He is expected in London shortly.

MORTON WEBBER is in Arizona.

E. A. WEINBERG will leave Melbourne on January 27 on his way to London.

JOSEPH WEIR is manager of the Iodide (Mineral Hill) silver-lead mine, N.S.W.

A. S. WHEELER is home from Rhodesia.

W. FISCHER WILKINSON has returned from New York, where he testified in the Hawthorne case.

HERBERT C. WOOLMER, the manager of the Spassky, is in London.

Erroneous press despatches in connection with the Hawthorne trial have confounded the identities of ROBERT BELL, late acting-director of the Canadian Geological Survey, and J. MACKINTOSH BELL, mining geologist to Messrs. Ehrlich & Co., London. J. MACKINTOSH BELL has no connection whatever, either directly or indirectly, with the Hawthorne matter.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

MELBOURNE.

Retrospect.—As this letter will reach London at the beginning of the year, it is not out of place to review the progress of the mining industry in Australia during 1912. Taking gold-mining first, as representing about half the total value of the mineral production of Australia, it will be found, when the detailed statistics are available, that throughout Australia there has been a substantial decrease in the output. For the first 10 months of this year, the total output was 1,911,000 oz. This gives an average of practically 190,000 oz. per month, as against an average of 200,000 in 1911, and 226,000 oz. in 1910. For the ten months, the Commonwealth production was 160,793 oz. less than a year ago, and 356,553 oz. below the figures two years ago. If the output for the whole year 1912 be approximated, it will stand at about 2,300,000 oz. This output compares with 2,488,000 oz. for 1911 and 2,719,945 oz. for 1910. The reduction is a serious matter to the Commonwealth, for it means a decline in one of our most important exports. Unless fresh gold discoveries are made, the dwindling will be continued. We have not properly explored more than a very small portion of the arid interior of Australia, and there is no reason to assume that in the vast extent of country that lies between the settled districts of New South Wales and Queensland, as well as Port Darwin to the North and Adelaide to the South, there are no opportunities for the prospector. At the same time sufficient field-work has been done to indicate that, as with Kalgoorlie, any future discoveries will be the result of strenuous prospecting. Owing to the unparalleled prosperity with which Australia has been blessed during the last six years and the high prices that have ruled for other metals than gold, population has withdrawn from the gold-mining industry, and it does not seem likely that prospecting will be again seriously undertaken until some greater inducement exists than is the case at present for men to go out into the back country.

In the settled areas, Western Australia is still the largest producer of gold, but there the gradual impoverishment of the formations that are being worked at Kalgoorlie and other of the older mining centres has told on the out-

put. In Victoria the decline of gold mining is even more marked than in Western Australia, and unless something fresh is found in the mountainous district of East Gippsland or in the Divide, any extension of the area in which gold-mining is carried on is improbable. At Bendigo, however, the development of the side lines is going on satisfactorily, and that district may have a decided revival, because of the extent of the side lines to be worked as compared with the operations on the four main saddle formations during the past 50 years. It is gratifying to know also that developments in the Ararat district, on the Langi Logan deep lead, promise well for a revival in this class of mining. The lead is practically untouched except in its shallow reaches. Work done at the New Langi Logan seems to point to the existence of a rich run of gold in the Langi gutter, and surface boring seems to indicate that 8 miles of this deep-lead system should be worked. Of course until the lead is entered no one can tell whether the results will be profitable. If they are, it will be the irony of fate that these properties, which were once in the control of British capitalists, slipped through their fingers, as did the profitable mines on the Cathcart Tributary. In New South Wales nothing of interest has occurred to lead to a revival of the gold-mining industry, and in Queensland there is no blinking the fact that gold-mining is far less prosperous than formerly. There has been no revival at Charters Towers, Gympie, Croydon, or in the back country. In South Australia and Tasmania, gold-mining has always been a negligible quantity.

Lead and Zinc.—While this is the case with gold, the industrial metals such as copper, lead, zinc, and tin, are certainly in a better position than a year ago. The greatest mining district in Australia continues to be Broken Hill. Looking at the output of the mines there, it seems incredible that a few years ago people should be so despondent about its future. Of course it is impossible to ignore the fact that the Broken Hill Proprietary is nearing its end. So are Block 10 and Block 14, but the discovery at the British mine of a new shoot of ore has raised that property to the front rank as a mine with a long life. The greatest mine of the Barrier today is the

South. To the north of it the developments in the Central mine at 1,200 ft. indicate that that property also has a long life ahead. Then in the North mine at the other end of the range the 1,200 ft. level promises to be the best the company has ever had. The despised South Blocks at the extreme south end has developed exceedingly well, especially at the No. 6 level, while in addition it has the prospect of getting within its boundaries valuable shoots of ore which are now being worked by the South company. Of course, what has helped Broken Hill has been the evolution of the flotation processes, in respect of which the district undoubtedly leads the world. There is talk of further fusions, with the object of ensuring a long life to some of the process companies.

Copper.—There has been an extension of the copper-mining industry, due to work done in the district in North Queensland, of which Cloncurry is the centre. The Mount Elliott mine has led the way and has been followed by the Hampden, which now is turning out blister copper at the rate of about 700 tons per month. Later on, it is certain that the Mount Cuthbert and Mount Oxide mines will appear as large producers. A number of outside mines in the large area covered by the Cloncurry district are being developed, while away on the Gulf of Carpentaria and in the Northern Territory prospecting is going on most persistently and in some cases it has promise of ultimate success. The Mount Morgan mine has been gradually getting over its troubles with the smelters, and the reports available respecting the Great Cobar are that at the bottom level higher grade material has been reached. At the same time the problem will have to be faced here as well as in North Queensland of the handling of the low-grade material. In Tasmania, the Mount Lyell company has got its ore reserves, as the result of developments at the North Lyell mine, to over one million tons. The unfortunate fire, however, has compelled the company to keep that valuable property closed, and there is no indication that it will be re-opened for some time to come.

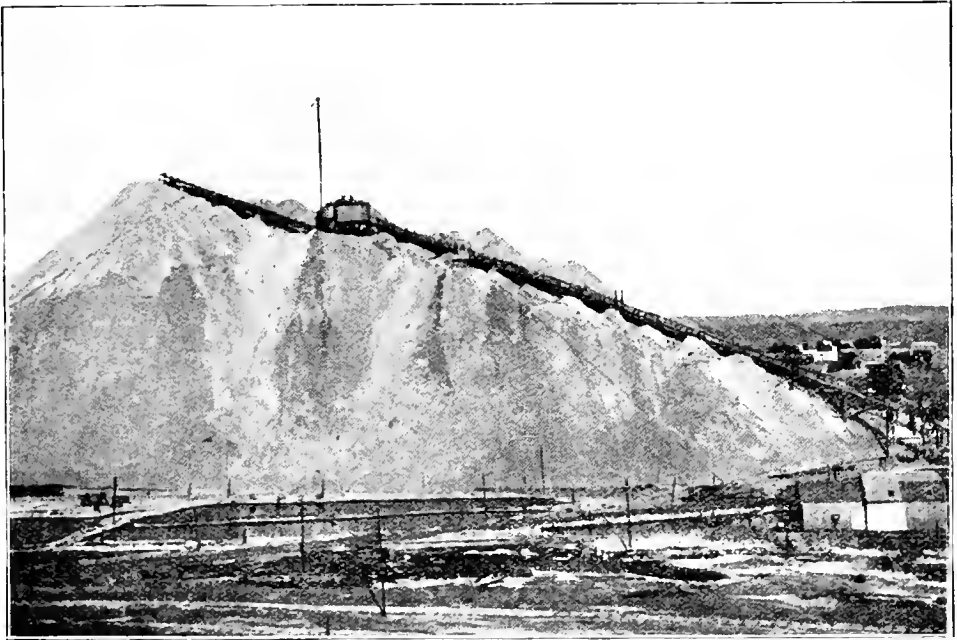
The tin-mining industry is slowly waning, though owing to the splendid work done at the Mount Bischoff mine that property seems to have gained a new lease of life. Should the operations at the Ringarooma lease of the Briseis company in northeast Tasmania prove satisfactory, that company too will see a revival of its fortunes. Still, the alluvial tin industry in North Tasmania and in North Queensland, as well as in New South Wales,

is dwindling seriously. Recently developments at the Ardlethan district in New South Wales, where tin ore occurring in porphyritic rock has been found, seem to point to a revival of lode-mining there. The general experience in Australia, however, is that tin lode-mining is disastrous to investors, and for that reason most people with capital fight shy of that side of the industry. It is an interesting commentary on conditions in Australia that a good deal of capital is going thence to the Malay peninsula to develop properties that can be worked by the bucket dredge. There seems to be some hope in view of what has been done at Inverell in New South Wales that the advent of Australian bucket-dredging methods at other properties than the Tongkah Harbour and Tongkah Compound in Malaya may bring a good deal of profit to Australian pockets.

Coal and Iron.—In reviewing the course of the mining industry, attention of course must be paid to coal and iron. The conviction is gradually being forced on people who have not paid much attention to the coal resources of Australia that New South Wales and Queensland both possess immense wealth in this direction. Of course coal mining in New South Wales is well established, and the coal of the State has a recognized position not only in the East, but on the west coast of America. So good is the coal and so cheaply is it mined that hitherto no attention has been paid to the possibilities of the brown-coal resources of Victoria. These lie within easy distance of Melbourne, and chiefly through the enterprise of some Victorian capitalists, German experts came some little time ago to report on the potentialities of the huge deposits at Morwell and Altona. Then C. H. Merz, an eminent London electrical engineer, was brought out to advise the Government as to the possibilities of electrifying the metropolitan railway system. Mr. Merz was impressed with the brown-coal deposits, and at the moment of writing a scheme is under the attention of Parliament for the electrification of the railways, the power to be generated from these brown-coal deposits. Parliament is sure to accept Mr. Merz's recommendations. If so, the huge seams at Morwell, aggregating 750 ft. in thickness, will be turned to account, not only for generating electric power but for the manufacture of oils and of sulphate of ammonia. The scheme that is proposed is perhaps the largest of its kind that the world has seen. The State Government is inclined to the opinion that private capital should be

permitted to undertake some portion of the development of the brown coal and the supply of electricity to the railways. Outside public opinion, however, seems to be unanimous that it would be wrong policy for the Government to allow a great public utility like the State railway system to be in any way controlled by private suppliers of electricity. Mr. Merz believes that power can be furnished so cheaply to Melbourne, provided the railway department and municipalities come in as customers, that the various manufactures will get exceedingly cheap electricity. Should this be the

Labour.—Connected with these industries, the labour question has ever been present. At Broken Hill the average wage that miners are now getting runs into nearly 20s. per 8-hours shift, as against about 14s. 12 months ago. Only the development of the zinc industry in that district and the high prices of metals could enable the companies to pay such wages. It would have been thought that with such wages labour would be content. The contrary is the position. Some anxiety is felt by the mine managers as to whether any disturbance may occur. What certainly tempts



CENTRAL DUMP OF THE SULPHIDE CORPORATION.

case, the effect upon the industrial future of Victoria will be most marked.

It is interesting, in this connection, to note that just as the zinc industry was started by the Broken Hill Proprietary, so now it is proposing to launch out as an iron master. The Supreme Court has just given the company the power to engage in the manufacture of iron and steel. The ore to be used at its iron-works, which are to be established at Newcastle, will come from the Iron Knob in South Australia. The Labour Government of New South Wales is pledged to create works of its own, but politics are so unsettled in that state that it is questionable whether the fruition of the labour ideal will be accomplished for many years to come, if ever.

the men to agitate is the magnificent profit that is being earned by the companies. A strong socialist element exists in the ranks of the miners, and they feel that if the mines are paying such splendid dividends then splendid wages ought to rule. In Kalgoorlie industrial unrest also exists, and there appears to be some fear that a strike may occur; but with the changed condition of mining there, owing to lower-grade material that has to be handled, it is evident to everyone that the Kalgoorlie miners cannot be given a largely increased wage. At Newcastle, discontent is rife, and the resistance of the men to discipline is so persistent that not a few predict an upheaval. Such a thing of course would imperil the whole industrial world of Australia. In Victoria, the

State coal mine is providing a wage which tells against the gold industry. Unionism is exceedingly aggressive, and its latest policy is to refuse to work for non-unionists. Union officials refuse to accept men who, though unionists, decline to sign the labour party's political platform. All this is due to the demand for labour, and any return to bad seasons or any large influx of population without a corresponding expansion of employment would lead to a recasting of the whole of the rates of pay for labour in Australia.

KALGOORLIE.

Ora Banda. After three months' trial G. M. Roberts, manager of the Associated Northern, owners of the Victorious mine, at Ora Banda, finds that the carbonates in the mineralized salt water clog the filter-cloth, and render it impossible for the Ridgway filters to treat more than 5000 tons monthly against the 12,000 tons anticipated. This has completely upset Mr. Roberts' calculations of a monthly profit of £6000. To add to his troubles, the grade of ore treated in October only returned 18s. 9d. per ton, against 21s. 3d. previously. Mr. Roberts is now experimenting to see if he can surmount the difficulty without adding more filter-presses. Owing to the Government storage-tanks not having yet been erected at Ora Banda, although lying there for months, any failure of the pumps at Black Flag instantly cuts off the water supply, and causes a suspension of treatment.

It is fair to point to the fact that the treatment of 70 tons daily of kaolinized ore is good work for any filter. The error was in supposing that such ore, when crushed, could be filtered advantageously.—EDITOR.]

Tributors.—The Central Boulder lease, which is only 396 by 666 ft., is a striking example of how easily experts of the highest standing may utterly fail, and working miners of no scientific education succeed. This block was worked by a London company from 1895 to 1904 without success. From 1904 to 1908 it was turned over to the Associated to be worked from their drifts on the north on half-profits, with negative results. From 1908 to the end of 1910, the Oroya-Brown Hill worked it on the same terms from cross-cuts from the Oroya South block, also in vain. It was then handed over to tributors, who, from the 100-ft. level, in 12 months, won £28,980 from 10,700 tons, and paid the company £4280 in royalties. Another party of tributors then outbid the first party, and, after 12 months' failure, retired defeated. A third party then

started, and picked up a lode at a depth of 30 ft. only, and their first return of 110 tons has just yielded nearly £5 per ton. If such a state of affairs can occur in a small block of six acres jammed in between the Associated, Oroya, and Lake View Consols, the question may well be asked how many lodes have still to be found on the large areas. In 1908 tributors found the west lode in Chaffers, and won £49,300 from 16,000 tons, while they paid £7300 in royalties. Only last year tributors found a new pipe on the Oroya, from which they won £35,000 and paid the company £7400 in royalties. Quite recently a tributor on Hamman's Reward discovered that the drift at 400 ft. had been driven off the lode; he proved the lode to be 12 ft. wide, and a test crushing from it gave a return of 57s. per ton. Managers of companies are so tied down by working costs that they dare not risk comparisons with their neighbours by spending money away from their main workings. Until shareholders and directors realize this, and give managers a free hand to let tributes, anywhere away from the main workings, their properties will never be thoroughly tested.

Kalgurli Consolidation. It is rumoured here that the North Kalgurli is to be taken over by the South Kalgurli, and residents are hoping that the report is true. The North Kalgurli has produced £290,000 from 115,000 tons, but the only people who have benefited are the wages men, tributors, and storekeepers, as shareholders have got nothing. Under present conditions the position of shareholders is utterly hopeless. Since tributing started, seven years ago, no less than 66,000 tons has been treated for a return of £130,000, and royalties of £20,000 have been paid. In addition to those on the spot, the directors and secretary in London have retained their positions, and seem likely to do so, as some £15,000 has been accumulated. If John Morgan assumes control the mine will be run to pay dividends, and not merely as a benevolent asylum.

A Cornish Venture.—M. T. Taylor, manager of the Great Fitzroy copper mine in Queensland, has been appointed manager of the Phoenix tin mine in Cornwall, floated in 1909 by the Hannan's Proprietary and Cosmopolitan companies, which were reported to have received 24,000 and 36,000 shares on the flotation. Wonderful reports were circulated here regarding the mine, and shareholders were led to believe that there was a lode on the property two miles long as proved by old workings. Nothing has been heard out here of the property for years, and those interested

are wondering whether Mr. Taylor's appointment is to be taken as a good omen or not. The result is awaited with interest.

Great Boulder.—Richard Hamilton, manager of the Great Boulder, has called for tenders for sinking two prospecting shafts, each to a depth of 150 ft., on the Great Victoria, at Nevoria. Judging from the nature of the ground these shafts will be sunk well inside a month, and it will then be seen what Mr. Hamilton intends to do with the venture. Robert Robinson has been appointed manager, he being a nominee of Sydney Yeo, who represents Messrs. Lionel Robinson, Clark & Co., of London. Messrs. Yeo and Hamilton have all along been jointly connected with this proposition.

Labour.—All business here is at a standstill owing to the uncertainty regarding the wages question. George MacLeod, secretary of the Miners' Union, has issued a circular to all the Workers' Unions in the Commonwealth appealing to them for aid when a strike, or lock-out, occurs at the end of the month. Mr. MacLeod goes on to point out that if no aid is forthcoming the workers will be starved into submission. He says nothing of the Water Scheme having to shut-down, and the railways becoming devoid of traffic, and the consequent utter ruin of the State's credit. This comes of putting a man of 24 years of age in a position of responsibility which he is quite incapable of filling.

TORONTO.

Porcupine.—Work at the mines and mills is still considerably retarded by the general strike of miners belonging to the Western Federation. The strike was declared on November 15, and shows no sign of coming to a close. A large number of strike-breakers have been brought in from time to time by the Hollinger and Dome mining companies, but many of these, on learning the real condition of affairs, have joined the strikers. Frequent attempts made by the strikers and their sympathizers to intercept parties of strike-breakers have resulted in several affrays between the strikers and the special police retained by the companies, the most serious of these occurring on December 1, when a party of Thiel detectives fired on a crowd of strikers, wounding three. In consequence of the strong local feeling aroused against the Thiel men, a large force of provincial police was entrusted with the duty of preserving order. Latterly quiet has prevailed. The Dome and Hollinger are stated to have secured their full quota of men, but many

of the new-comers are inexperienced, and operations are conducted at a disadvantage and with considerably increased expenses. The pipe-line from the Dome to Porcupine lake, which will insure a good supply of water, is nearly completed. The construction of the McIntyre mill has been much delayed, but the work is now being pushed and the machinery is on the ground ready for installation. At the Pearl Lake, where the strike was settled, the shaft is now nearing the 600-ft. level, where the rich vein cut on the 400-ft. level will be opened-up. Should the result equal anticipations, the capacity of the mill will be enlarged. The mill of the Three Nations is well under way. It will have 10 stamps and six Deister-Reid slime-tables, giving a capacity of 100 tons per day. This will bring the number of mills in operation or under construction in the Porcupine district up to eight. The Crown Chartered last month made a good find on the North Davidson claim, the vein being 18 in. in width with abundant free gold showings. The company has been in financial difficulties and in order to pay the balance due on the Davidson claims, amounting to \$45,000, the shareholders have arranged with a syndicate to advance the money, on condition of being repaid \$60,000 within three months. If default is made, the syndicate is to take possession of the property. The Dome Lake is being re-organized with a capitalization reduced from \$2,500,000 to \$500,000, the shareholders turning in their stock and receiving in exchange 1 new share for every 6 $\frac{2}{3}$ shares deposited. This will leave sufficient stock in the treasury to provide for additional financing. The Porcupine Townsite, which owns two claims adjacent to the Hughes, and other property, has made an agreement with a British syndicate, under which a new company will be formed under the English Companies' Act capitalized at £75,000 in shares of 5s. each. Present shareholders will receive one share in the new company for every 10 now held. Development will be resumed in the spring. The Deloro Mohawk has uncovered seven veins for over 200 ft., several of which are stated to show high gold-contents. Traces of platinum have also been found, and it is hoped that this metal may be found in commercial quantity. The 10-stamp mill at the Swastika mine is nearly completed, and operations will be started early in January. John Redington, as consulting engineer, states that there is now enough ore on hand to pay the cost of the property and return a substantial dividend. The Tough claims, near Kirkland lake in the Swastika district,

are yielding rich ore, 21 tons estimated to run over \$300 per ton have been shipped from an open cut to a Cobalt sampling plant.

Cobalt.—Cobalt issues have been showing a good deal of activity lately owing to encouraging discoveries and the payment of big dividends by several of the leading companies. Among the declarations at the close of the year are the McKinley-Darragh with 20%, and the Buffalo with 26%. The latest accession to the list of dividend-payers is the Cobalt Lake, which has announced an interim dividend of 2½%. A late forecast of the approximate value of the year's output puts it at about \$17,000,000, some reduction in the quantity of silver produced being considerably more than offset by the increase in the price of the metal. The La Rose has for the first time declared a bonus amounting to 2½%, bringing its payment for the quarter up to 5%. The company has renewed its contract for the treatment of its low-grade ore with the Northern Customs concentrator for another five years. The agreement calls for the delivery of 100 tons per day, indicating that the mine must have a large tonnage of low-grade ore available. A new vein recently opened-up on the Right of Way has been found to extend into the La Rose property, and cross-cutting has been started to pick it up. The November statement showed net profits for the month of \$130,884, and a surplus on hand, including value of ore shipments, of \$1,788,276. Large shipments have been made from the new vein struck by the Seneca-Superior, under Cart lake, a drift having proved a continuous ore-shoot 3 to 4 in. wide of 3000 oz. ore, the wall-rock on each side being impregnated for several feet with leaf silver. The Peterson Lake company is itself working the property in the same locality formerly held by the Little Nipissing under lease, and has a good body of milling ore at the 350-ft. level. Cross-cutting is being done to find richer ore, and extensive diamond-drilling is being planned. The Beaver is down 700 ft., and is now the deepest mine in the district. A cross-cut is being driven at the bottom level. If successful, the shaft will be sunk deeper. The company has now good ore in three levels below the Keewatin, and is steadily improving its financial position, having an available balance on hand, on December 1, of \$141,873. A British syndicate has acquired a controlling interest in the Cobalt Lake, Sir Henry Pellatt having given an option on 1,000,000 shares held by him, the other shareholders being given the opportunity to sell on the same terms. The options extend over a term of 13 months, the stock to be taken up by instalments, at a series

of dates on a sliding scale of prices averaging about 73½ cents, per share. The purchasing parties represent the controlling interests of the Cobalt Townsite and the Casey Cobalt companies and will organize a new company in London. The output of the mine for the current year is estimated at about 1,000,000 oz. silver, giving net profits of approximately \$450,000. A strike of native silver is reported on a claim in the Gillies Limit. The vein is of ruby silver, and occurs between the diabase and the Keewatin. The Island Smelting & Refining Co., the holders of a newly discovered process for treating refractory ores, have taken over the plant of the Cobalt Smelter, Ltd., at Trout lake. The shareholders of the latter company will receive 300,000 shares of Island Smelter stock, and the Island Smelter Co. will be financially re-organized. The Trout Lake smelter will be put in condition and treat high-grade ores, and another plant will be built to handle low-grade ores by the Island process.

Government Investigations.—Two important investigations in connection with the mining industry are being undertaken by the Canadian Mining Department. One has been arranged to ascertain whether the cobalt content of Cobalt ores, for which there is now but little demand, can be substituted for nickel as an iron alloy. The Geological Survey has also commissioned Joseph Keele, geologist in charge of the clay investigation, to carry on experimental work in clays and shales in the laboratory of the Mining Department of Toronto University, with a view to testing the commercial uses to which extensive deposits of clays and shales in Canada can be put. The demand for this class of products has increased greatly of late years owing to the enormous amount of construction work undertaken, and the results of the inquiry should lead to the establishment of important new industries.

Nickel Mining.—The past season has witnessed unusual activity in the Sudbury mining district, owing to the increased demand for nickel for naval armaments. As the Sudbury field supplies about 60% of the world's supply of the metal, the fear of being unable to dispose of their output in a restricted market controlled by the Canadian Copper Co., which until recently kept many properties idle, is no longer operative, as under present conditions the supply cannot overtake the greatly increased requirements. Accordingly the old companies are pushing development and largely increasing their ore resources, and new concerns are being established. The Canadian Copper Co. has resumed work on the Froid

mine and other properties closed for years, and has largely increased its holdings. Important changes have been made in its Copper Cliff smelter by the addition of a reverberatory furnace to treat fine ore and dust, and in the introduction of immense converters with a basic lining to replace the small acid-lined converters. The Mond Nickel Co. has extended its operations by the erection of a large modern smelter at Coniston, which will turn out nickel-matte on a large scale. The Dominion Nickel & Copper Co., which has for some time owned large and valuable properties, is preparing to enter the market and will build another large smelter. Recent investigations have shown

have also been discounted in part, so that the market, though reduced to a state of weakness and inactivity, is in condition to advance as further relief from present restraints is obtained. It is unlikely that the last month's sudden decline reflects in any true degree the actual condition of business and industry throughout the country in general. Bank clearings, which indicate fairly accurately the volume of business throughout the country, have varied little in their totals for the last four or five weeks.

Mining shares have declined in proportion with the rest of the market, with the prominent exception of the Braden, despite the



THE NIPISSING MINE, AT COBALT.

that the orebodies show great continuity, leading to the belief that mining at a profound depth will be profitable and that the camp will enjoy an unusual degree of prosperity.

NEW YORK.

Share-Market.—The causes that brought on the recent break, bordering on panic, in the share-market are difficult of discovery. Suffice it to say that the favourable positive factors of great new wealth from the harvest, heavy industrial earnings, etc., have been more than neutralized by the over-strained banking situation, the Government's decisions in its suits against trusts, the European war, and the anticipation of tariff revision. The heavy liquidation that has taken place, by which nearly \$300,000,000 of paper-value has been wiped off the slate, has done a great deal toward relieving the banking and currency situation. By this liquidation the other adverse factors

handicap of being over-capitalized. The Braden Copper Co. is capitalized at \$14,000,000, of which \$8,000,000 is held in the treasury against outstanding convertible bonds. Its bond issues are \$4,000,000 of 6% ten-year first-lien convertible bonds, \$1,000,000 of 7% five-year second-lien convertible bonds, and \$2,000,000 of 7% three-year convertible debentures. The company is also authorized to issue \$2,000,000 in coupon bonds. On the basis of present contemplated equipment, with the plant fully installed, a copper production of 50,000,000 lb. per annum is prophesied. There is little doubt that the rise in price and the high level maintained during an adverse market were due to inside knowledge of the property and so-called inside buying.

The properties owned by the Alaska Syndicate (a Guggenheim-Morgan control) appear to be operating successfully. The Kennecott Mines Co., capitalized at \$3,000,000, by its

recent payment of a \$1,000,000 dividend, has now raised its total dividend figures to \$2,000,000. It is reported that the company has been shipping ore that assayed 71% copper and 8 to 20 oz. silver. An estimate of its reserves, as given by L. M. Storm, is as follows: 80,000 tons of 50% copper ore in the main orebody, and 50,000 tons of 12% ore in the talus or broken outcrop. The ore occurs as a replacement in limestone, the high-grade stuff being the result of secondary enrichment. The Copper River & Northwestern Railroad, also owned by the Alaska Syndicate, was built from the coast to the Kennecott or Bonanza property, a distance of 200 miles, at a cost of \$17,000,000, including equipment. The railroad company is capitalized at \$5,000,000, and has an issue of \$50,000,000 in bonds. This capitalization has nothing to do with the mine. The Beatson Copper Co., also controlled by the Syndicate, has developed and partly equipped its property. Shipments of varying volume have been made since 1903. This property is situated about 3 miles from the northern end of La Touche island, practically on tide-water with good harbour facilities, and forms an interesting contrast to the Kennecott, the situation of which necessitated the enormous expenditure in railroad-building mentioned above. At the present time the shipping ore of the Beatson property averages about 7% copper, with small amounts of gold and silver. Besides this shipping ore, the mine is said to have considerable low-grade concentrating ore developed.

Copper.—The Guggenheim interests, with A. C. Burrage of Boston, have become largely interested in the Chuquicamata property near Antofagasta, Chile. This property is unusual in that the ore is a basic sulphate of copper averaging about 2% copper. Experiments have demonstrated that it is possible to recover the copper by leaching. The property has been extensively drilled. Frederick Hellmann, of New York, will shortly leave for the property to take charge of the operations.

The Granby Consolidated Mining, Smelting, & Power Co., operating in the Boundary district, British Columbia, will erect a 2000-ton smelter for its new Hidden Creek mine. The past financing of this property has been unusual in that the Granby Company has done it out of current earnings. Some \$2,000,000 more will be required to bring the Hidden Creek property to production. The company has not yet decided whether to continue its policy of equipping the Hidden Creek mine out of earnings, or to issue securities to cover

future expenditures. It will be remembered that the Hidden Creek property was acquired through the purchase of 80% of its capital stock at a cost of \$400,000.

The Nevada Consolidated at Ely, Nevada, has made an extra distribution of 50 c. per share. The effect of this will probably be reflected in an increased dividend by the Utah Copper Co., which controls 1,000,500 shares of the Nevada Consolidated. There is talk of a merger of the Giroux mine with the Copper Mines Co., in which the Gunn-Thompson interests are largely interested. The Ray Consolidated Company will soon be in a position to increase its production. It is announced that the high-grade orebody in the old Ray Central ground is now accessible for extraction through the recently completed shaft. It is stated that the production from this shaft will be brought up to 600 tons per day. The admixture of this richer ore will bring the average grade going to the mill up to 2% copper. A re-calculation of the Chino tonnage now gives that mine 90,000,000 tons of ore averaging 1.83% copper. The previous estimate was 55,000,000 tons of ore averaging 2.24%. It is stated that there will be less stripping in mining when this lower grade of ore is included.

Various.—The La France Co. at Butte, Montana, was sold by the sheriff and was purchased by a representative of the stockholders committee for \$100,000. It is stated that the Lexington mine of this company will be re-opened, as the possibilities of it developing into a zinc property are good.

The Goldfield Consolidated has suspended dividends for an indefinite period; the grade of ore now going to the mill being \$15 per ton. Dividends of 1¼% quarterly have been resumed by the Mines Company of America after passing the two previous dividends. As the Dolores mine, one of the chief subsidiaries of this Company, was in the centre of the recent political trouble in Chihuahua, the resumption of dividends is looked upon as encouraging the expectation of quiet in this part of Mexico.

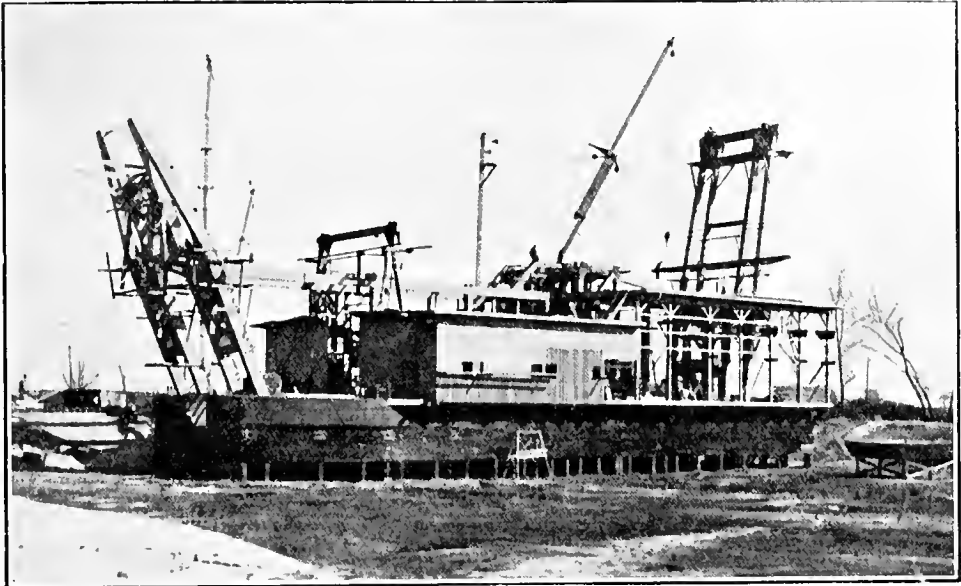
SAN FRANCISCO.

Copper.—In no other part of the metallurgical field has progress in America been more marked during the past year than in the recovery of copper from its ores. The smelting of copper is so old an art that it might perhaps be expected by now to have fallen into beaten paths. On the contrary, study and experiment are continuous and, as chang-

ing conditions permit, notable changes in practice are put into effect. The most striking development of the year is the sudden and unanimous adoption of the Great Falls, or vertical, type of converter in the smelters of Arizona and Mexico, where the horizontal Leghorn, or Bisbee, type has long held supreme. The cause of this is the universal adoption of the basic lining, which, with care, can be made to last for two years or more without renewal. If a proper coating is secured, chemical and mechanical corrosion is practically eliminated; therefore it becomes of prime importance to

a proper distribution of the solids added. At the Great Falls plant of the Anaconda Copper Mining Co., where the vertical converter was developed, a 20-ft. converter was blown in during the summer, and has been remarkably successful in operation. The labour cost of converting has been greatly reduced by the use of such shells, in which over 125 tons of matte and 25 to 30 tons of solid material are converted in 50 tons of blister copper at one 'blow.'

Gold dredging is the salient feature of metal recovery in California, since there are



YUBA DREDGE No. 13 UNDER CONSTRUCTION FOR THE YUBA CONSOLIDATED GOLDFIELDS.

so design and place the lining that mechanical strains, due to repeated heating and cooling over a long period of time, shall be provided for. In the Bisbee converter, the lining is in the shape of a broken horizontal cylinder with a superimposed cone, a structurally weak shape, while the Great Falls construction employs a vertical unbroken cylinder, a correspondingly strong design. This factor is of such importance that the Great Falls type has been adopted by the American Smelting & Refining Co. (which owns the Peirce-Smith patents) for use in its plants, and it is not at all unlikely that within a few years the horizontal cylinder type of construction will be obsolete. When the Peirce-Smith converter first appeared it was at once recognized that the single small opening at one end of a long cylinder was highly inconvenient in securing

more and larger dredges at work in California than anywhere else in the world. During 1912 there were, according to Charles Janin, 64 dredges at work, handling in the year 68,000,000 cu. yd., with an average gold content of 11 c. per yard, as compared with about 12c. in 1911. The world's record is held by Natomas No. 4, a 13-ft. dredge which handled 4,056,400 cu. yd. from an average depth of 19 ft., at a cost of 24c. per yard. This was in favourable ground, so that the single dredge handled an amount almost equal to that handled by the five dredges of the Oroville, Ltd. Comparisons of this sort are not strictly proper, however, for the amount handled and the cost depend upon the conditions to be met. For example a 5-ft. boat belonging to the Oro Light & Power Co. for three years handled an average of 200 yd. per hour, but on moving to

another part of the same property only averaged 80 yd. per hour. Operating costs at Oroville range from under 4 to over 10 c. per cubic yard, because of varying conditions, so that off-hand comparisons cannot justly be made. The following summary of the operations of the largest dredging companies in California has been prepared by Mr. Janin.

		1910	1911	1912
Natomas Con. of California	Cubic yards	15,588,362	22,270,586	24,000,000
	Recovery per yd.	9.64	9.21	
	Cost per yd.	5.52	3.91	
		Year end ing Feb. 28, 1910	Year end ing Feb. 28, 1911	
Yuba Con. Gold Fields	Cubic yards	15,970,728	15,757,264	15,000,000
	Recovery per yd.	10.88	10.86	
	Cost per yd.	5.67	4.67	
		July 31, 1910	July 31, 1911	
Oroville Dredging, Ltd.	Cubic yards	5,661,612	4,433,262	3,512,842
	Recovery per yd.	9.91	10.42	10.29
	Cost per yd.	5.05	4.52	5.03

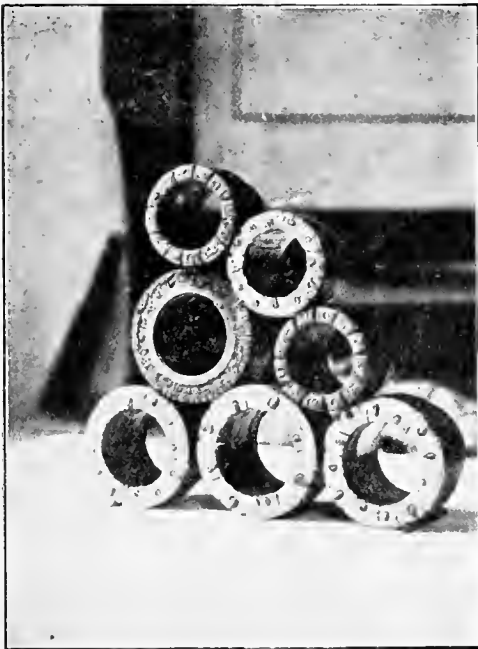
Oil Fuel in Smelting. — Interesting changes in furnace construction have also been made. The Colorado Iron Works has of recent years been attempting to develop an oil-fired blast furnace, following the successful use of liquid fuel in reverberatory smelting. Last year experiments were made with a similar furnace in British Columbia with reported good results, but nothing more was done. Early this year the Pioneer Smelting Co. built an oil-fired furnace at Corwin, Pima county, Arizona, and the statements at the time of the first blowing-in indicate that it worked successfully, though no later information is available. Theoretically oil-firing should find a certain field in blast-furnace smelting, but it is so limited that it is doubtful whether any company is likely to spend sufficiently large sums on experiment to put practice on a sure working basis. It is unfortunate that new methods such as this are usually tried out at small properties, where a great variety of troubles not incident to the process itself overlap and complicate its essential difficulties.

Reverberatory smelting has been characterized by notable changes as well. At Copper Cliff in Ontario, the Canadian Copper Co. has built reverberatories, using coal-dust as fuel; these were designed by D. H. Browne. Coal-dust firing was first tried at the Highland Boy smelter, near Salt Lake City, some years ago, and though a number of operating difficulties developed, a plant was designed to use this method. It was never built, however, for the plant was closed down on account of smelter-fume agitation. Later, at Cananea, it was again tried, but the coal available was of poor quality and the trouble from blanketing the top of the charge with a coating of infusible ash, a poor conductor of heat, was excessive.

Experiments were soon discontinued, for it was early found that California crude oil could be procured at a price that made it a cheaper fuel than coal, even aside from the operating advantages secured by its use. In Ontario an abundant supply of low-ash bituminous coal from the Middle Western states is available, and no trouble has been experienced from ash. Comparative smelting costs before and after the change would be of interest, but these are not available. At Great Falls, Montana, gas-producers have been in use, the smelting furnaces being provided with regenerative checker-work of the Siemens type. The producers worked well, but dust from the charge lodged in the checker-work so that shut-downs and expense in cleaning-out the chambers was a constant necessity. In the new construction, now in progress, the small gas-fired reverberatory furnaces will be replaced by coal-fired furnaces of the ordinary size, with waste-heat boilers and specially designed fire-boxes, which are in effect direct-connected gas-producers. The furnaces at Copper Cliff and Great Falls represent extremes of type, since the coal used at Great Falls averages over 25% ash.

Smelter fume has been the source of a great deal of trouble during recent years, especially since the outburst of opposition by agriculturists in Utah. More factors than the damage actually done by the fume entered into the Utah controversy, making it too complex for analysis here, but the outcome was that the farmers were sustained and all of the plants ceased copper smelting, though two of them continued to smelt lead ores. This victory strengthened the hand of the farmer everywhere, and the Anaconda company in Montana and all the plants in California were seriously involved soon afterward. By purchasing some farms in the 'smoke' zone and cultivating them more successfully than their original owners had ever done, the Anaconda company outgeneraled the farmers in their attempt to prove damage from fume, but the Federal Government took a hand on the ground that the fume was killing trees on the public domain. As a matter of fact most of the supposedly injured trees had been killed by forest fires. Saner counsels finally prevailed and an arbitration committee of eminent engineers and metallurgists was appointed to consider the question. This has not yet reported, as the Bureau of Mines is engaged in experimental work upon the problems of fume control. In California the situation was similar, since the timber on public domain was again

involved. One of the companies agreed to neutralize its gases before allowing them to escape, to remove all solid particles, and to keep the percentage of SO_2 in the escaping gases at all times below 0.75. The Mountain Copper Co. had already escaped from the scene of trouble by moving its plant to near Martinez and building a sulphuric acid plant; the Mammoth company built a baghouse, the zinc present in the ore serving to neutralize the SO_3 formed by contact action, which, though somewhat expensive to operate proved eminently successful as a foil against trouble.



Diamond-drill Crowns for $\frac{3}{4}$ -inch bore-holes, as used for prospecting underground on the Rand.

But the Balaklala, which had installed the Cottrell process for eliminating solids and SO_3 from the fume, fell under the hand of the law and was closed by the courts, as it was unable to prove that it either removed all the solid particles or kept the SO_2 at all times below the allowable maximum. As a result the copper production of California decreased 17,000,000 lb. in 1911 as compared with 1905. Recently the association of farmers has been threatening trouble for the Mammoth company. The lack of logic in the situation is illustrated by the fact that the total value of the real estate in Shasta county is only about $2\frac{1}{2}$ times the sum represented by the decrease

in output of copper in 1911, as compared with 1909, and the total damage done to agriculture since smelting operations first began is probably not over $\frac{1}{4}$ of the sum expended by the Mammoth company in the construction of its baghouse plant. It is certainly poor economics to allow a minor industry to dominate and hamper a major one.

JOHANNESBURG.

The Brakpan, the pioneer deep-level mine of the Far East Rand, continues to be a bright spot, which is steadily becoming brighter. The yield per ton crushed has maintained a steady level all through, the figure for the month of November being 30s. 6d. The cost has come down quietly to 16s. 7d., and the profit per ton is more or less stationary at 13s. 11d. The tonnage crushed reached the designed amount of 60,000 in October, that is to say, the company accomplished what it had set out to do in 17 months after dropping the first stamps. This point is of some interest, as it shows that even a well-equipped and competently managed property must work into its stride gradually, and that the beautiful picture in the mind of the ordinary investor of a plant erected, a button pressed, and everything in full swing from the word 'Go,' is but the dream of a visionary. Another interesting fact is that it has cost £1,200,000 to equip and develop the mine, thus fully confirming the generally accepted opinion that a deep-level gold mine will swallow up a million pounds before it disgorges any dividends. The company was entirely out of debt at the end of April, and is now making working profits at the rate of £40,000 per month. Assuming that 80% of this will be distributable, the dividend for 1913 should be 50%. A dividend of 15% was paid in June, and one of 25% in December, and everything points to half-yearly distributions of 25% in the immediate future. The success of this mine has caused quite a revival of interest in the district, and it has considerably lightened the labours of those who preside at the annual meetings of companies holding ground in the neighbourhood. When prospects are bright, a tactful reference to Brakpan makes them brilliant: when they are discouraging, an allusion to the good results shown by that company sends everyone home in a hopeful frame of mind.

Crown Mines declared a dividend of 55% in December, which, with the 55% declared in June, makes 110% for the year. From this it is evident that the realization of the hopes of patient shareholders, that dividends at the rate of 130% per annum would be soon forth-

coming, must remain in abeyance. Two things have so far militated against the success of this amalgamation: heavy capital expenditure and shortage of native labour. The former was the consequence of faulty estimates, and the latter has been always with us. The result of this combination of adverse factors is that the company has had to saddle itself with a debenture issue of £1,000,000. From a mining point of view the outlook is satisfactory. The ore reserve on a stoping basis amounted at the end of 1911 to 10,124,072 tons of an average value of 7'25 dwt., and underground results are maintaining this average, as shown by the fact that 366,000 tons of 6'8 dwt. ore were developed during the six months ending in June, 1912, and 783,401 tons of 7'5 dwt. ore during the quarter ending in September. Provided, therefore, that selective mining has not been applied to any great extent the value of the ore reserve at the end of 1912 should show little difference as compared with that recorded at the end of 1911. An important point to note, however, is the steady fall in the yield per ton accompanied with a steady but not so rapid fall in the cost per ton, the final result being a fall in the profit per ton; but this is balanced by the greater tonnage crushed. The yield is expected, according to the statement made by the managing director on December 12, 1911, to drop to 7'1 dwt. or 29s. 10d. per ton; this is exactly 1s. lower than the yield of October, when the working cost was 18s. 2d. per ton. If, therefore, better results are to be obtained, either the working cost must come down much more rapidly or the tonnage crushed must be greatly increased. The capacity of the reduction plant is 230,000 tons per month, and the rate of crushing in October was 167,800 tons, which shows how large is the leeway yet to be made up. Capital expenditure has now reached a normal level, but the statement made by Mr. Samuel Evans at the extraordinary general meeting on August 30, 1912, that "after an expenditure of about £150,000, we shall have completed all the capital expenditure work necessary to enable the whole of the claims north of the South Rand dike to be worked out," seems to be somewhat conservative in view of the work still to be done. There is also the large untouched area south of the dike to be considered, as the expense of developing this will be extremely heavy, but as one third of the intact claims, or 36,000,000 tons of ore, are north of the dike, this expenditure will not have to be faced for many years to come. The future of this huge undertaking depends on the supply of native labour; the ore is there and

the equipment is there; but whether or not sufficient labour will ever be forthcoming to enable full advantage to be taken of the potentialities of this property is a question that no one is, at present, in a position to answer.

The Geldenhuis Deep position is not encouraging. During the year 1911 an average tonnage of 66,822 tons was milled per month, and this amount has steadily dwindled until in October of this year it was only 48,500. In the same month the yield was 32s. 5d., which shows an advance; the working cost was 27s. 3d., a big increase; the working profit was 5s. 2d., a decrease on the 1911 figure of 5s. 8d.; the total working profit was £12,569, a notable drop from the 1911 average of £20,942. In the September quarter of this year the working profit was only £15,030, or 2s. 1d. per ton milled. During 1911, 1,448,614 stope tons of ore were exposed, of which only 652,663 tons of 6'7 dwt. value, or 45%, were profitable; and of the tonnage mined only 60% came from the reserve. For the six months ending 30 June, 1912, 111,023 tons were fully developed of an average value of 6'5 dwt., which is a slight advance on the value of the ore reserve, 6'2 dwt., at the end of last year. The tonnage, however, is not sufficient to keep pace with the depletion of the reserve, as the development footage, owing to the shortage of native labour, is much below requirements. The working cost, at 27s. 3d., is remarkably high for such a large property, and a yield of 32s. 5d. is equally so, considering the average of the ore reserve, and the large amount of unprofitable material milled. A dividend of 10% was declared in June, and one of 5% in December, the decrease reflecting the poor results recently obtained.

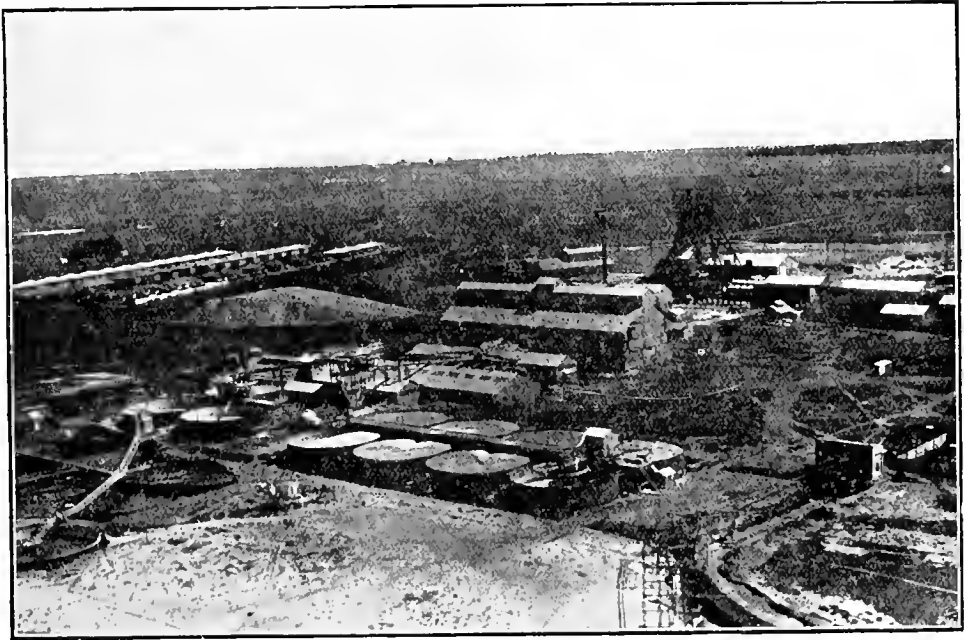
Dust-Allayer.—A patent has been granted to Mr. Ussher for his method of allaying dust underground by spraying rock-faces with a weak solution of molasses or treacle. The idea underlying the use of a sugary by-product is to keep the surfaces over which dust passes in a moist and sticky condition, thereby ensuring that the floating silicious particles shall be caught, much as flies are caught on fly-paper. The City Deep has been trying this plan for the best part of a year, and although no official pronouncement has been made as to the success of the extended trial, it is generally understood that the employment of water-plus-treacle has led to a considerable betterment in the underground conditions. In the workings where the spraying has been mostly conducted, an evidence of efficiency is furnished by the putty-like coating on the rock-walls. This is a compound of quartzite dust and moist sugar.

The molasses employed is the uncrystallizable syrup obtained in the boiling-down of raw sugar; it contains about 70% of sugar, and is a thick, sticky, dark-brown semi-liquid. As it is practically a waste product of the Natal sugar-mills, it can be obtained in large quantity and at a low price. In using the solution, a small percentage of one of the coal-tar derivatives is added in order to render it aseptic, and thus prevent the growth of deleterious organisms.

Mining Exhibition.—The second annual mining exhibition is to be held in April, 1913,

device connected with his work will take this opportunity to bring it to the notice of the public. Admission to the exhibition will be free. In general, the affair promises to be a popular success, especially if it is conducted on good live lines. What bores the mining public more than anything is rows of glass cases with mining things in them, and what attracts them is a life-saving demonstration or a well illustrated lecture on the various ways of breaking ground, or some similar subject.

After-Dinner Statistics.—The "brains to the square inch" gentlemen who are popularly



THE BRAKPAN MINE, SHOWING REDUCTION PLANT AND No. 2 SHAFT.

under the auspices of the Chemical, Metallurgical, and Mining Society. The exhibition will last for a fortnight, and the authorities have kindly given permission for the Volunteer drill-hall to be used for the purpose. While the exhibition is open, it is proposed to give several lectures and demonstrations on ambulance work, manufactures, appliances, and machinery; and there is no doubt that this will prove a highly attractive feature, provided the lecturers are experts in their subjects and know how to lecture. Those engaged or interested in mining work in any of its branches are to be specially considered, in the hope that they and the industry will both benefit. It is hoped that anyone who may have any model of any

supposed to form such a large percentage of the population of Johannesburg, have been singularly reticent during recent years, at least so far as post-prandial oratory is concerned. There has been much speaking, but little eloquence. At the Rand Pioneers' dinner some instructive figures were supplied by that genial veteran of finance, Sir George Albu. He told his hearers that the present valuation of the mining industry was £110,000,000, and that the dividends and interest on debentures paid out last year amounted to 7.3% on that valuation. He qualified this statement by drawing attention to the fact that every year at least 1,000 claims of a minimum total value of £2,000,000 were exhausted, and that when this

was taken into account the actual profits came to only 5%. Mr. S. R. Potter (president of the Transvaal Society of Journalists) remarked that it had become a habit of certain of their public men when stuck for a phrase or a sentence with which to tickle the taste, invariably to resort to abuse of the Press. Press-men and pioneers had much in common, and the gentlemen he referred to, who did not come under either category, might one day awake to the discovery that the sources of modern journalism were not exhausted.

The dinner of the Chemical, Metallurgical, and Mining Society was also productive of some interesting notes. The Minister of Mines, Mr. F. S. Malan, said he found that the mining industry stood for an annual value of nearly £48,000,000 and employed 38,000 white employees and 279,000 other than Europeans, making a grand total of 317,000 individuals having a direct connection with, and earning a livelihood out of, the industry, and that the Government drew from it an annual revenue of £2,333,000. The president of the Society, Mr. W. R. Dowling, referred to the efforts of the Trades School and the Wolluter State Mining School to assist white lads to make themselves skilled workers and thus compete successfully with the coloured tradesmen, who were steadily ousting the white worker in the Cape Colony. He pointed out that the mines crushed 25,000,000 tons of ore per annum, and produced therefrom £37,000,000. Of this sum £8,000,000 was distributed among white workers on the mines, £5,000,000 among coloured workers, £9,000,000 was paid for stores, £1,000,000 went to the State in direct taxation, and over £3,000,000 was expended in machinery, renewals, and capital expenditure. Thus the far greater portion of the yield was expended in South Africa, and upon this golden stream from the Rand depended in large measure the prosperity of the whole country. Lieut.-Col. C. B. Saner touched on that much discussed and apparently needless phase of Rand mining life: insecurity of tenure. He instanced the different attitudes of English and Rand employers, giving it as his opinion that there was more advantage to be derived from employing old and tried servants than in harnessing brilliant meteorites.

Both these functions were decidedly pleasant, and well patronized, but the figures and opinions ventured and the manner of their utterance were not compellingly arresting, and it would seem that at present there is not only a shortage in native labour, but also one in effective non-political after-dinner speakers.

There is, however, this consolation: the present matter-of-fact style of discourse is not so disturbing as the intellectual hooliganism of the early days.

Sorting.—The abolition of surface sorting at the Knights Deep has given rise to a deluge of discussion on this difficult and long dormant question. The Rand is becoming divided into two camps, the sorters and the non-sorters, the former being in an overwhelming majority. The subject is almost as old as the goldfield. In the past many practical demonstrations were conducted at the mines to settle this much debated point, the almost unanimous finding being that it pays to sort waste-rock every time. As against this decision there is now the fact that the engineering staff of the Consolidated Gold Fields has, after due deliberation, pronounced in favour of no surface sorting at the Knights Deep. It would require a long and complicated analysis to classify the many points that have to be considered in dealing with this matter, but there have been certain statements made at various times by men who thoroughly understand the problem, and at least two of these are worth quoting.

In the annual report of the New Kleinfontein mine for the year ending December 31, 1907, the consulting engineer, Mr. E. J. Way, placed the following figures and views on record:

Number of tons mined during				
1907	535,588
"	"	"	sorted out	146,367
"	"	"	milled	389,221

If no sorting had been done it would only have been necessary to mine 389,221 tons, so that costs would have been reduced by the cost of mining 146,367 tons. Mining cost of 146,367 tons at 7s. 9'752d. actual cost per ton mined and hauled to surface ... £57,175 16 7

The saving on the cost of sorting at 7d. per ton milled, the only charge being crushing ... 11,352 5 7

or a saving of 3s. 6'255d. per ton milled ... £68,528 2 2

Average cost per ton, 1907 £1 0 4'537
Less 0 3 6'255

Equals working costs per ton if no sorting had been done £0 16 10'282

Had no sorting been done and the working costs

been reduced to 16s. 10'28d. with the same number of tons milled, the grade of the ore milled would have been decreased to 24s. 9'192d., and the profit for the year, instead of being 11s. 10'318d. per ton, would have been 7s. 10'910d. This means a decrease of 3s. 11'408d. per ton, or a total of £76,884 2s. 5d. Very grave consideration has been given to this question for some time past. The assay-value of our waste-rock during the year has averaged approximately 1 dwt. The recovery value on our present basis of extraction, which is about 95%, should be 4s. 0'36d. The costs against which this gold has to be set are crushing (excluding sorting), milling, cyaniding, sliming, and surface maintenance. The figures for the present year totalled 4s. 3'969d. It will be seen, therefore, that if by any chance the waste-rock should be of greater value than the 1 dwt. stated, there is a possibility of rejecting profitable rock.

The next statement is taken from Mr. Jas. E. Thomas's chapter on sorting in 'Rand Metallurgical Practice': "As a general rule, waste may be sorted out provided the cost per ton rejected, including 80% of the value of its gold contents, does not exceed the cost of breaking, tramming, crushing, &c., per ton milled. Assuming that 15% of the rock is rejected of 0'8 dwt., and the cost of sorting and tramming to waste dump 3d. per ton milled, and that the cost of breaking, transport, crushing, &c. is 5s. per ton milled (cost on modern plants does not exceed 3s. 6d. per ton milled and is in some cases as low as 2s. 6d.):

Sorting per ton milled	...	0s. 3d.
" " " rejected	...	1s. 5d.
80% of value per ton rejected		2s. 8d.

		4s. 1d.

As the reduction in cost of breaking, transport, crushing, &c., due to the larger tonnage milled, were waste also crushed, would not exceed 3d. per ton milled, this case shows a gain in favour of sorting of about 8d. per ton.

☞ In the case of a modern plant working at a cost of, say, 3s. per ton, the result would be reversed:

Sorting per ton milled	...	0s. 3d.
" " " rejected	...	1s. 5d.
90% of value per ton rejected		3s. 0d.

		4s. 8d.

showing a gain in favour of non-sorting of about 1s. 8d. per ton. This, of course, neglects any capital redemption charges, which would be in favour of sorting, as the capital expend-

iture required for sorting plant is less than that required for plant for breaking, crushing, &c.

These two statements exhibit fairly well the various points that require particular attention when weighing the pros and cons. They both make it clear that the line of demarcation is a narrow one, but neither of them emphasizes the fact that by milling waste there is a probability of crowding out more profitable material to the detriment of present shareholders, though a careful reading of Mr. Way's remarks should make this clear. The average value of rejected waste is between 0'4 dwt. and 1'0 dwt., or 0'7 dwt. as a mean. And taking 80% as the probable extraction on such low-grade rock, there is a recovery of 2s. 4d. per ton to set against the cost. It should be evident from this that only under very exceptional circumstances would the milling of hoisted waste-rock be a profitable undertaking.

CAMBORNE.

Levant.—It must have been a pleasant surprise to the outside shareholders to find that a profit of £3740 had been earned for the sixteen weeks ended November 23 last, especially when the tone of the speeches at the last meeting, when the previous account showed a loss of £404, was recalled. The chairman's remarks were, on that occasion, rather doleful, and hardly such as to lead to an anticipation of a marked change. A suspicious person naturally looked to see whether the profit now reported was due to decreased development, or to the fact that, in the absence of a renewal of lease, the eyes of the mine were being picked out. However, the development for the period was normal, and although the underground force had been considerably reduced, which pointed at first sight to less stopping, the fact that the output had increased conclusively proved that neither of these were the real explanations. The profit appears to be due to three causes. First, the advance in the price of tin which is up £11 per ton, the improved produce of 5 lb. per ton and consequent increase in the black tin sales of about 12½ tons, and the decrease in the expenditure, chiefly on coal.

The total receipts for the four months were £18,381, or 43s. 9d. per ton milled, the expenditure £14,641 or 34s. 10d., and the profit £3740 or 8s. 10d. per ton. The profit, added to the amount brought forward, gave the adventurers £7332 available for distribution, but a dividend of only 15s. per share was declared, absorbing £1765, and leaving £5566 to be carried forward. Thus a deter-

mination was shown to have a substantial reserve fund in readiness for less prosperous times. Levant is now the only mine left of any consequence which is worked on the cost-book system, and it is satisfactory to know that the adventurers have recognized the folly of dividing profits up to the hilt, the cause of the untimely end of many a Cornish mine in the past. The manager reported that the developments in the bottom of the mine showed practically no improvement, but as they got further westward, he anticipated a change for the better. It has also been decided to retreat the tailing, and grinding plant driven by an oil engine is being erected.

St. Ives Consolidated Mines.—The recently issued report and accounts of this company, covering the 18 months ended June 30 last, show that, while the financial position of the company is weak, the prospects at the Giew and Consols sections of the property have considerably improved. It would appear from the accounts that there has been a net expenditure of something over £50,000 during the 18 months, in plant, development, and expenses at St. Ives and in London. This has been met partly by an issue of debentures of £59,500 (of which £32,000, however, was invested in bonds of the British Radium Corporation), partly by advances against security, and the balance is accounted for by increased trade liabilities.

In the Consols mine, the Sump shaft has been cleared, enlarged, and timbered to a depth of 860 feet; at the 77-fm. level, a pump station has been made in which has been installed duplicate electrically driven three-throw pumps with a capacity of 250 gallons per minute. East Virgin shaft is being used to unwater the whole of the Consols section, the unwatering being done with the air-lift working in conjunction with the sinking and station pumps. Only a further 162 feet remain to complete the clearing of this shaft to the bottom level (157 fathoms). The manager reports that large blocks of profitable stoping ground have been disclosed on the Standard lode in the various levels from East Virgin shaft, and although no figures of content are given, the ground already stoped assayed 21·7 lb. black tin per ton, and that taken from West Virgin shaft 27·5 lb. Little development on the lodes has so far been carried out, much attention having been devoted to non-productive development. The brightest prospect appears to be the Giew mine, which has been unwatered to the bottom, that is, 142 fm. below adit. The development has been prac-

tically confined to the Frank's shaft section, where six drifts have been extended 1311 ft. in virgin ground, the lode averaging 23 in. in width and assaying on the average 24 lb. black tin per ton. Eight rises in this ground have been put up 407 ft., the lode averaging 24 in. in width and assaying 20 lb. per ton. In the whole of the Giew section, the manager (F. C. Cann) estimates the ore-reserves on September 15 last at 25,000 tons of an average assay of 24·5 lb. black tin per ton. This compares with 52,000 tons of an average assay value of 20·58 lb. of black tin per ton given by Mr. Dietzsch in his report dated October 12, 1911. The mill on this property, consisting of 20 modern stamps and dressing plant, treated during the period under review 33,610 tons of ore, from which 257 tons of black tin was recovered, realizing £27,389. Part of this ore was from the dumps. It is interesting to note that the Giew power-plant, which consists of three Westinghouse gas engines, with Dowson gas producers, has generated, since it was started in October 1911, 702,363 units for an average consumption of 2·47 lb. of coal per unit, and at a total works-cost of 0·702 pence per unit.

Little reference was made to the Trenwith mine, which is now apparently held by the British Radium Corporation, in which company the St. Ives Consolidated has a controlling interest, but the chairman asserted, "it has been estimated that at the end of February last the gross value of the visible supply of pitchblende at the mine and radium and uranium in hand amounted to over £80,000."

Rock-Drill Prosecution.—The activity of the new Inspector of Mines is again shown by the recent prosecution of Dolcoath miners for not using the spray when working with rock-drills. It is a most difficult thing to get the men to use either the spray or respirators, but a few successful prosecutions may help to bring home to them the necessity for using these safeguards against dust inhalation.

Tax on Shaft-Sinking.—As I forecasted in August last, the appeal of the surveyor of taxes was upheld in the courts against the decision of the commissioners for income tax, according to which the money spent by the Basset mines in deepening Marriott's shaft was held to be a working cost and therefore allowable as a deduction in ascertaining the profits of the company. The Revenue authorities do not even allow a percentage to be written off such expenditure annually. The Basset Co. was badly advised to fight the appeal in view of the many previous decisions.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

Concentrating Ores by Flotation.

The Editor :

Sir—The attention of my board has been called to the review of this work appearing in *The Mining Magazine* for December 1912, on pages 460 and 461.

This review contains the following statement: "The book is published by the consent of the Minerals Separation Co. after the text had been carefully read, although there is reason to believe that they are not in agreement with all the views expressed by the author."

I am desired by my board to state that their consent was requested only in connection with matters over which my company had control. As a matter of fact, approval of the book in its present form was neither sought for nor given. My board consider it necessary to emphasize the fact that they cannot support many of the statements in Mr. Hoover's book, whether they refer to the affairs of my company or to other matters.

The high standing of your magazine, and your well known impartiality, are additional reasons for making this communication to you.

MINERALS SEPARATION LD.

A. O. Williams,

London, December 16. Secretary.

Capital Amortization.

The Editor :

Sir—I have read the article entitled 'Debentures in Mining' in your issue of November last. The writer, Mr. Morton Webber, advocates the amortization of the capital of mining companies in order to increase the stability of mining securities, so that an investor who invests some years after a mine had been operating, would face much the same conditions as had he invested at the initiation of the enterprise.

Commendable as this may appear on the face of it, from the point of view of an original investor it is not attractive, inasmuch as during the period required for amortization, say 10 years, he would perforce receive smaller dividends and be deprived of the use of a portion, probably half, of the money he would otherwise have received during that period.

Further, he would not be entitled to receive his portion of the money set aside for capital redemption until the winding up of the company, at some future date.

With due deference to Mr. Webber's opini-

on, the original investor is more useful to the mining industry than an investor who buys shares years after a mine is started, and it is obvious that he should not be called upon to set aside a portion of his earnings to provide greater security for others who come in later on. The collateral trust bond suggested by Mr. Webber, or an issue of debentures or preferred shares to cover the capital requirements, affords fuller security to the investor than ordinary stock under any scheme of amortization, besides possessing the attraction of sharing in enhanced profits as ordinary shares on arriving at maturity, should the enterprise be successful.

A. G. WHITE.

London, December 9, 1912.

Cobalt Conglomerate.

The Editor :

Sir—In your November issue, on page 323, you have a paragraph comparing Cobalt conglomerate with that of the Rand. I think your description of the Cobalt conglomerate must refer to the more massive greywacke portions only. As you may see by reference to the accompanying photographs, there are some readily recognizable phases of the conglomerate. In these there are veins of the same richness as in the greywacke. The rocks are much hardened, but do not show much evidence of severe crushing.

Additional evidence of lack of deformation in these old rocks may be noted in the ripple-marked quartzite, which is bedded with the conglomerate and has been exposed by hydraulicicking at the Nipissing mine.

REGINALD E. HORE.

Houghton, Michigan,

December 11, 1912.

The Editor :

Sir—Permit me to take exception to the note on the Cobalt conglomerate, which appeared in the editorial section of your magazine for November, page 323.

You state, "that only an expert geologist would recognize as conglomerate the Huronian rocks, where penetrated by the silver calcite veins of Cobalt." On the contrary, the great proportion of the conglomerate proper is easily recognized by a novice, and the pebble or breccia structure is usually most marked. In certain places, the conglomerate has been considerably altered, and also, it shades off into greywacke, arkose, slate, and quartzite, the exact classification of which demands careful study.

I am enclosing a photograph from the report of the Ontario Geological Survey, showing the breccia conglomerate formed *in situ*. Elsewhere they are found well rounded and water-worn pebbles of Laurentian and Keweenaw rocks, some of which appear to have been carried for long distances before being laid down; and although the chemical composition of the pebbles and the cementing material is quite different, much of the Huronian conglomerate does — in form — resemble the basket of the Rand. In outlying portions of the Cobalt district, there are frequently areas of very coarse conglomerate with boulders ranging from the size of a cobble-stone up to a weight of one to two tons.

At the Millerett mine, Gowganda, the medium size pebbles were sorted out of the ore as it went to the concentrator and used in the pebble-mill in place of flint pebbles and with very good result. I understand that this is also practiced at some of the mills on the Rand.

G. M. COLVOCORESSES.

New York, December 16, 1912.

[The photographs sent by Mr. Hore will serve to illustrate the statement of Mr. Colvocoresses also. The print from the Ontario Geological Survey proved too indistinct for reproduction.—EDITOR].

Cornish Problems.

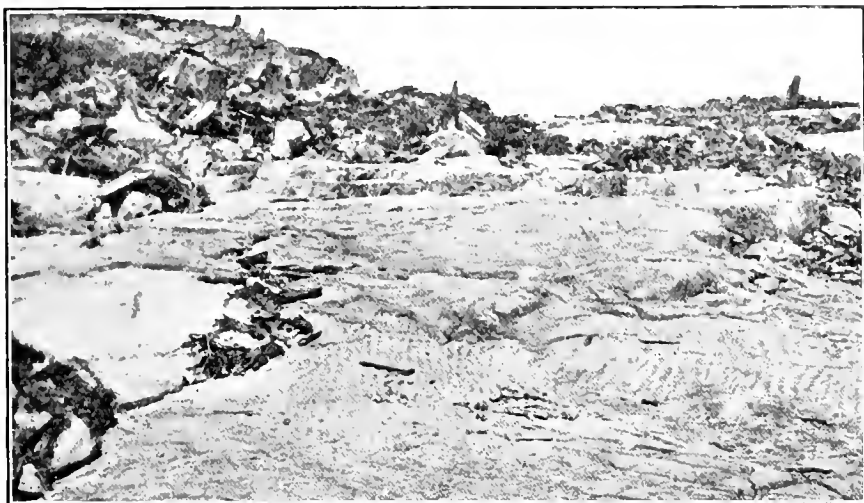
The Editor:

Sir—Most of the contributors to the discussion on Mr. W. Fischer Wilkinson's paper, at the recent meeting of the Institution of Mining and Metallurgy, give first prominence to the comparison of assay methods, but in my opinion this part of the paper was of little importance. A much more useful service to metallurgical practice was done by the author when he commenced to study extraction and classification, and to me the most vital item in the paper was the result obtained by coarse crushing. Mr. Wilkinson crushed in stamps having a 4-mesh screen and obtained as a first concentrate on a Buss table 42% of the cassiterite in the ore in a concentrate assaying 32% metal. The screen employed was made of wire of less diameter than the width of the hole, and we may take the aperture to be $\frac{3}{16}$ inch. The Buss table acted as a classifier as well as a concentrator, and it was possible to obtain three other products. His scheme for subsequent treatment involving sizing, classifying, and re-grinding, and one of the ultimate products, the oversize in the tailing from the Frue and Acme machines, could be rejected

as too poor to re-grind. Owing to limited resources in the way of plant, he was unable to obtain satisfactory results, but I feel so sure that the experiments will lead to something eventually useful that I hope Mr. J. J. Beringer and Mr. W. J. Shepherd, the manager at the King Edward mine, will continue them. It has commonly been supposed that Cornish ores require fine grinding, because the particles of cassiterite are fine, and Mr. Wilkinson's recovery with so coarse a mesh is therefore notable. Other mine managers in Cornwall have discovered that past practice is not infallible. Prominent among them is Mr. Josiah Paull of South Crofty, who uses 14-mesh. At the Geevor mine stage-crushing with Hardinge mills instead of stamps is being tried, and the results are most promising.

A thorough examination of tin ore by screen-analysis should be undertaken, and this would form an excellent subject for research at the Camborne School of Mines. This system of examining ores has been adopted with gratifying results at many copper, lead, and zinc mines, and recently, as recorded in a paper read before the South African Society by Mr. Morris Green, for investigating the mode of occurrence of gold in an unusually refractory ore. Mr. Green's investigation affords a model which might well be studied and followed by other seekers after exact information.

I have mentioned that Mr. Wilkinson obtained 42% of the cassiterite of the ore as a first concentrate, assaying 32% metal. The fact that this concentrate is of low grade suggests another topic for discussion from the point of view of its acceptableness to the smelter. Tin extraction is still in the hands of the smelters, as was copper in Swansea forty years ago, and the mines are not fully in touch with the details. Unless a mine-owner smelts his own ore he never can strike a balance between concentration and smelting. A trifling modification in concentration might mean an enormous saving at the smelter, and a slight variation in smelting practice might be of great importance to a mine. At the present time it is supposed in Cornwall that the smelter wants a black tin as free from gangue and other mineral as possible, and much expense is incurred in dressing, as well as loss of cassiterite, in attempting to attain this ideal. Some smelters, however, are not keen on buying such material, probably because the high price leaves them no profit. They prefer to buy lower grade concentrate, because the penalization affords them a larger margin for their ingenuity and activity. In Bolivia no attempt



RIPPLE MARKINGS ON QUARTZITE, ON THE NIPISSING GROUND



HURONIAN CONGLOMERATE.

is made to produce a concentrate higher than 60% metal, and the buyers at Liverpool and Hamburg are perfectly satisfied with their bargains. The question arises therefore whether it is not possible to smelt a tin concentrate containing 32% metal such as Mr. Wilkinson produced. I am aware that tin oxide and copper-iron sulphide cannot be compared as to treatment, and that tin has a strong affinity for silica. The latter fact is usually supposed to be overwhelming against the presence of much silica in a tin concentrate. Nevertheless I believe that the tin smelter is cognizant of reactions which remove silica without the abstraction of too much tin. Incidentally I would say that the mine managers in Cornwall do not make the most of their case when low recovery in concentration is discussed, for they fail to mention that much of the loss is due to the attempt to meet the smelters' supposed desire for a high-grade product. There are also a great many problems in tin smelting from the point of view of the marketable metal produced that are not known to the mine owner. It is possible even that some metallic constituents of tin concentrate, that are now penalized, are in fact desirable in producing brands of tin required for certain specific purposes. The relative properties of the varying grades of tin are little understood outside the circle of smelters, tin-plate manufacturers, and makers of bronze, pewter, and other alloys, and it will not be until the mines smelt their own ores or until some disinterested metallurgist makes public his experience that such knowledge will be generally available.

EDWARD WALKER.

London, January 4.

Premature Precipitation.

The Editor:

Sir—I am sorry that my letter in the June issue was not sufficiently clear to Mr. A. W. Allen. There was an extraction of 76.1% of the silver and 95% of the gold contained in the original ore. Mr. Allen wrote in the February issue that about 76% of the valuable content had been extracted. I think, when he sees the above figures, that he will pardon me for saying that he quite forgot to reckon the gold.

In my opinion, the commercial question should always be considered in a metallurgical test. The valuable content of an ore is quite a different thing from the combined metallic content. It is upon the latter that Mr. Allen has based his calculations. In the pre-

sent discussion, to take the sum of the original gold and silver contents and to subtract from it the sum of the gold and silver contents of the residue, and to calculate from this the percentage extraction of valuable content is quite erroneous. In this instance the gold and silver must be separately estimated at their commercial value; the residue must be estimated likewise. The result is an extraction of 85.2% of the valuable content.

The question is raised by Mr. Allen as to whether I am in a position to speak with certainty when referring to the use of charcoal as a precipitant. I am simply going by current literature. J. E. Clennell, in 'The Cyanide Handbook,' writes in the past tense on the use of charcoal as a precipitant (page 122). On page 308 he says that "the method has been used on several small plants in Victoria, Australia, on a working scale." On the other hand, H. W. MacFarren, in 'The Text-Book of Cyanide Practice,' makes no mention of precipitation by charcoal. The older textbooks quote Deeble's plant at Bendigo, Victoria, as an example of charcoal precipitation. If this plant were still working it would have been mentioned by Mr. M. W. von Bernerwitz in his article 'Metallurgy at Bendigo,' which appeared in the *Mining and Scientific Press* of August 17, 1912. I have been in touch with practically all cyanide publications for several years, and during the past two years I do not remember reading of any plant using charcoal precipitation. In these circumstances I think I am perfectly right in saying that charcoal precipitation should be mentioned in the past tense.

In remarking that had I agitated the pulp with zinc shavings instead of the unfortunate mixture supplied by nature "the zinc would have gone into solution forming zinc-potassic cyanide combinations," it does not necessarily follow that I referred only to the double cyanide of zinc and potassium. I was explaining to Mr. Allen, in a rather obscure manner, that zinc under the circumstances was subject to chemical change, whereas charcoal was not.

DONALD F. FOSTER.

Prestea, West Africa,

November 27, 1912.

Nipissing.—In regard to the mill for the treatment of high-grade silver ore, from this mine, at Cobalt, Ontario, described by T. A. Rickard in the June issue of this Magazine, it appears that credit for the design of the plant should be shared by G. H. Clevenger, with Charles Butters.

ZINC PRODUCTION AT BROKEN HILL

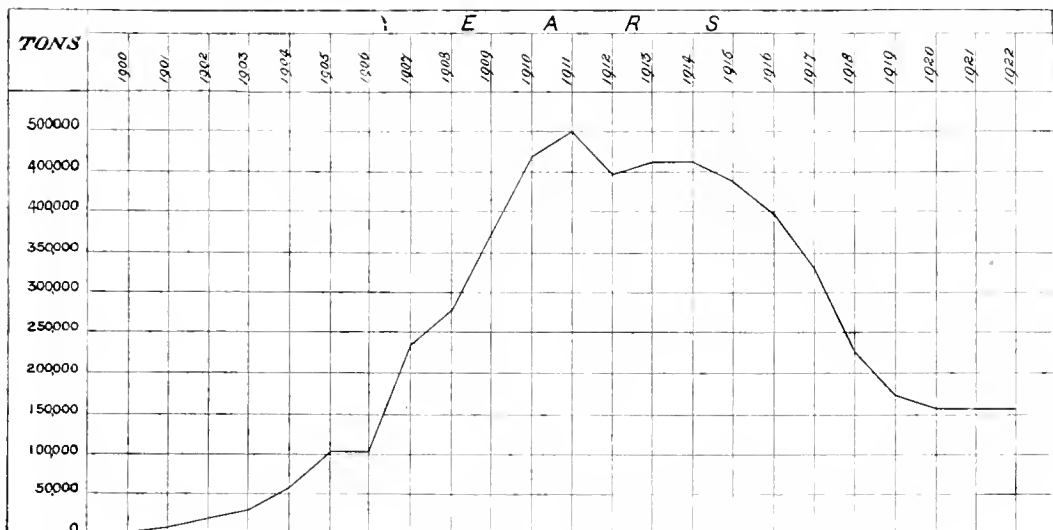
By THEODORE J. HOOVER.

THE figures for 1912 are sufficiently complete for the Broken Hill district to make possible a fairly accurate estimate of the total production of zinc concentrate for the year. This will come to about 440,000 tons, a decrease as compared with 1911 of 60,000 tons. An uncertain factor in the situation is that several of the companies are storing concentrate, and it is rather difficult to distinguish between the concentrate that was stored in 1911 and sold in 1912, and that which was stored during 1912. For all practical purposes, however, the above figure is accurate enough for the present purpose.

companies not to produce beyond the requirements of the selling contracts. It is worthy of remark that this tremendous increase in the production of spelter from one district had no marked effect on the price of the metal.

The chief purpose of any statistical inquiry is to forecast future production. As the production of this district will have a predominating influence on the market price of spelter for many years to come, the matter is well worthy of close study. The curve shown in the annexed diagram was constructed on the following assumptions:

1. That there will be no further large zinc



PRODUCTION OF ZINC CONCENTRATE AT BROKEN HILL.

I have prepared a curve showing the production of zinc concentrate in Broken Hill since 1900. The early production was almost entirely from the Sulphide Corporation's magnetic plant, which was superseded later by the flotation process. The first effect of flotation processes on the world's supply of spelter was felt in 1904, and in 1906 the spectacular rise in Broken Hill zinc production began. Between the years 1906 and 1911 the production rose from 100,000 tons of zinc concentrate to roughly 500,000 of concentrate, 1911 being the pinnacle of production. The lower production of 1912 was due to the lower grade of material treated and a policy on the part of the

concentrating plants erected, and that those that have already been erected will be kept at their present capacity.

2. That there are no further large discoveries of new deposits or new lodes of zinc ore in the district, and that the actual increase in the reserve of zinc ore will be due to orderly development within the boundaries of the present known zinc-lead orebodies.

3. Due consideration has been given, not only to actual reserves of ore blocked out, but to reasonable anticipations of probable ore in all the mines; and careful estimates in each individual case have been made as to life-expectancy of the property in question.

4. The actual tonnage of tailing accumulated and stacked is accurately known, and the present rate at which this residue is being consumed is a matter of positive knowledge. We can prognosticate with a fair degree of accuracy when each plant will finish the accumulated tailing available for it, and from a summation of these end-points, we can calculate the curve of zinc-production from accumulated tailing.

On these assumptions the curve shows that the production for the years 1910, 1911, 1912, 1913, 1914, and 1915 will be very nearly equal, and in the neighbourhood of 400,000 to 450,000 tons of zinc concentrate.

Putting together then all that we know of the production to be derived from accumulated tailing, ore blocked out, probable ore, and miner's expectancy of life, we see that the curve in the neighbourhood of 1915 begins a rapid drop, and falls with about constant acceleration during the years 1917, 1918, and 1919. In 1920 the zinc production of Broken Hill reaches a level where it will be derived exclusively from the current tailing being produced from ore mined and milled at that time. Certain deductions can also be drawn, either from the curve or the figures involved in the construction of the curve, as to the future lead production, and the present value of Broken Hill mining companies' shares.

Output of Minerals in Great Britain

FOR five or more years past, the publication of the Government reports relating to the output of minerals in the United Kingdom has gradually become later, until this year the detailed figures for 1911 have made their appearance during the first week of 1913. It is not necessary at this time of day to plead that statistics of production must be obtained and given promptly if they are to be of current value. We content ourselves with expressing the hope that the Home Office will in future afford proper facilities for the publication of these statistics. As usual coal represents the largest factor in the mineral wealth of the Kingdom: the output in 1911 was 271,891,899 tons, an increase of 7,458,871 tons over 1910. The price obtained at pit's mouth averaged 8s. 1d. per ton, a figure practically identical with that for the year before. Of the production, 64,599,266 tons was exported to foreign countries, the largest customers being France, with 10,272,959 tons and Italy with 9,223,081 tons. In addition, 1,059,876 tons of coke and 1,612,741 tons of briquette fuel was exported, and 19,264,189 tons of coal was supplied to

British and foreign steamships. Of the home consumption 34,460,640 tons was used in coke and gas manufacture, and 1,636,217 tons for briquettes.

The production of iron ore during 1911 was 15,519,424 tons, an increase of 293,409 tons as compared with 1910. The amount of pig obtainable therefrom was 5,020,510 tons, or rather more than half the iron produced in the Kingdom. The North Yorkshire and the Lincolnshire ores are carbonates, averaging 30% metal, and the Cumberland ores are hematite, averaging 50%. The imports of iron ore totalled 6,346,599, as compared with 7,020,799 tons during 1910; the largest imports, 3,945,605 tons, came from Spain; the figures for 1910 were 4,854,606 tons.

The output of black tin for 1911 was 7746 tons, of which 6246 was sold at the ticketings. About one-half of that sold by private contract probably came from the stream-works. The amount of metal obtainable by smelting was 4872 tons. The average metallic content of the sand concentrate was 65% and of the slime 45%.

The production of lead ore shows a decrease, the concentrate produced being 23,910 tons, a fall of 4624 compared with 1910. The metallic content extractable was estimated at 17,990 tons lead and 118,395 oz. silver. The largest producers were Mill Close in Derbyshire, Boltsburn in Durham, Greenside in Westmorland, Halkyn and Rhosesmor in Flint, Queensberry and Leadhills in South Scotland. On the other hand, the output of zinc ores has increased, the figures for dressed ore being 17,652 tons, as compared with 11,238 tons in 1910. The estimated metallic yield was 6098 tons. The largest producers were the Nenthead and Carr Shield at Alston in Cumberland, and the Great Laxey in the Isle of Man. During the year, 74,394 tons of zinc concentrate was imported, the chief sources being Italy, Broken Hill, and North Africa. The production at the Alston and one or two other north country mines was shipped to Belgium for treatment; in fact the Alston mines are worked by the Vieille Montagne Company. The output of copper concentrate was 3262 tons estimated to contain 392 tons of metal. This was a fall of 916 tons of concentrate as compared with 1910. The Levant in Cornwall and the Glasdir in Wales were the chief producers. The deliveries of china-clay and china-stone during 1911 were 867,224 tons as compared with 827,441 tons the year before. The figures relating to the last-named minerals are not collected from the individual pits, but from the shipments by sea and rail.

JOURNEYS IN NIGERIA

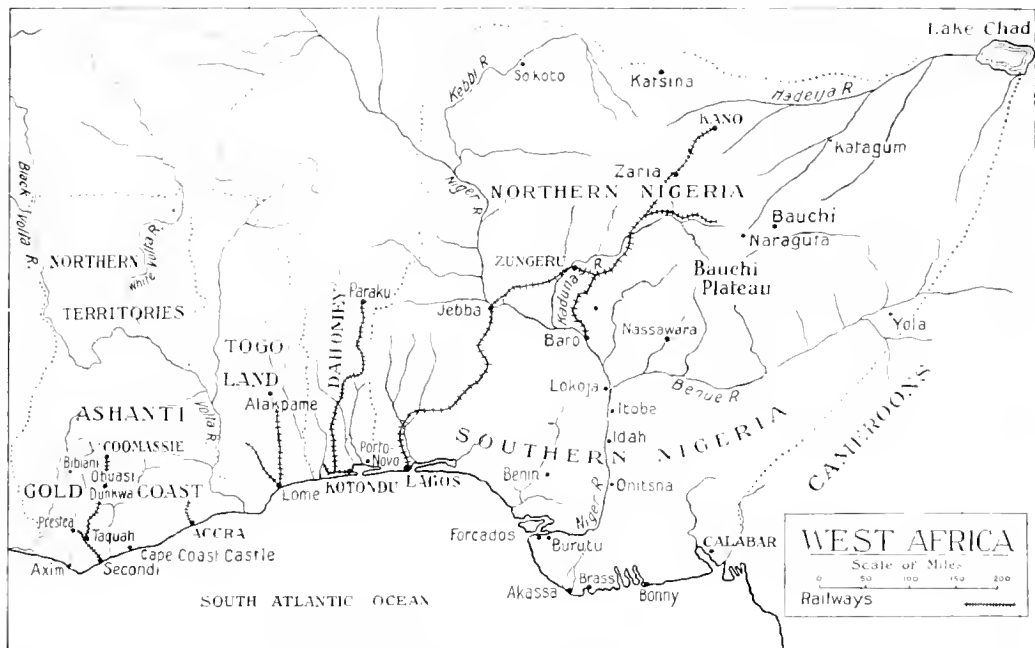
A mining engineer's experiences, with illustrations by himself.

By J. B. RICHARDSON

JOURNEYS in remote parts of the world are always interesting, and Northern Nigeria, especially the plateau region, has been so much in evidence of late because of the discovery of mineral wealth, that it will interest those at home to learn what the country looks like and what is the ordinary life of the people.

The Bauchi highlands, the plateau itself, the surrounding hills, and the plains below provide a wonderful variety of landscape and

It is a beautiful country, where Nature has been allowed to take her own course and man has always given way to her, not fought and tussled at every turn. The black man waits for the boiling torrent to subside before he crosses it, and he walks round the bush or the stone that lies in his path; but now the wonderful white man has come to build bridges and to cut straight roads. It has wonderful possibilities, and may easily become a fine jewel in the crown of the Empire, if only the



inhabitants. It is surely the most picturesque and interesting part of an interesting region, well populated with many different types and races, all with their curious and characteristic customs, their own peculiar arts and industries.

Whether it will become in time a second India, as some forecast, it is impossible to say; but it is being rapidly opened up and developed; railways are being built, mines are being operated; there is a large influx of British enterprise and capital, bringing a tide of peace and prosperity such as the natives have never known.

right men are given the task of cutting and polishing.

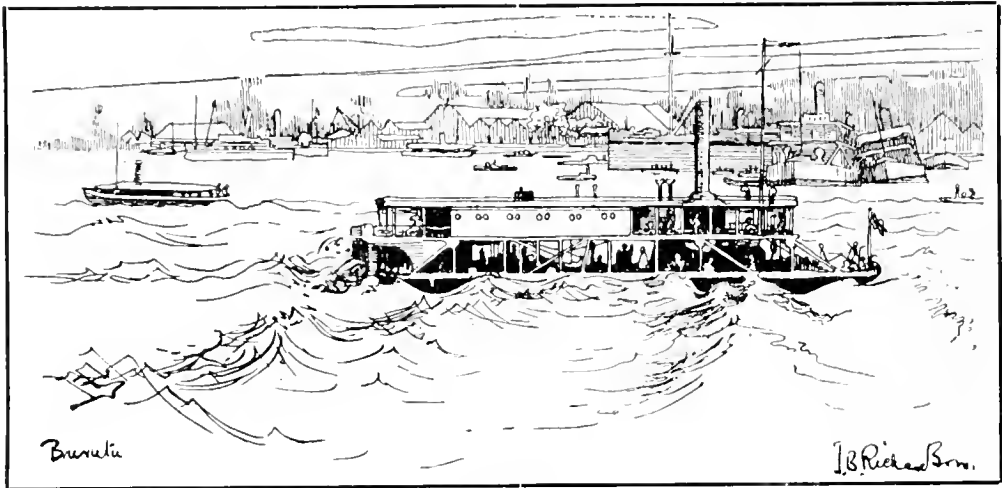
It is a remarkable fact that if you were to parade a hundred people who have transhipped at Forcados from the ocean-steamer to the river-boat, and were to ask those who found it raining there to step forward, almost certainly the whole of them would advance as one man.

That particular gateway to Nigeria is a very watery one, and does not inspire the unhappy exile with any of the pride of empire. As the liner slowly and cautiously crosses the bar in order not to bump too hard, and steams mourn-

fully to her moorings off the Government station of Forcados, the new-comers stand dismally around, clad in mackintoshes and sun-helmets, and survey the grey-green waters of the delta with the dark low line of mangroves in the background and the heavy grey sky above, wondering if this melancholy scene is a good sample of what the country offers in the way of landscape. The more experienced travellers sit in the square comfortably yawning and drinking their last civilized drinks, and, carefully avoiding the dismal, all-pervading dampness outside, indulge in reminiscences of home and the theatres, and cheer themselves with hope of future joys and merriment.

should not be punished for it." Notice too the bitter tone of the master who wrote, "This boy is a thief, a liar, he cannot cook or keep clean, is lazy and has no sense. Otherwise he is satisfactory and as good as the average steward boy." Another classic anecdote is that of the mess-cook who left "on account of health—our health."

After some time spent with the negro representatives of the Customs while they extract much revenue, and having interviewed your own particular agent, you hurry off to where a confused mass of men, black and white, are emptying the hold, and endeavour to collect your belongings, vainly trying to check the numbers against your invoices. Every minute



BURUTU.

As soon as the doctor has boarded, a crowd of launches and boats come laden with Government officials, traders, agents, black clerks, and a throng of servant boys. The white men join the group in the square, while the black clerks harass and question the wretched passengers, and the clean, newly-washed boys proffer their books to all and sundry.

To the new arrivals the reading of these books is amusing, as it shows the cynicism of a long-suffering master or the obvious forgery of a semi-educated black clerk. There is a tale told of a boy who used to frequent the incoming boats week after week; his book always gained a round of laughter but never a job. Apparently a high official had earned the spite and animosity of an army man, who had named his boy after the official and then gave him a reference to the effect that "So-and-so is the most damnable blackguard in the world; I hate the sight of him; I should like to beat the life out of him if I thought I

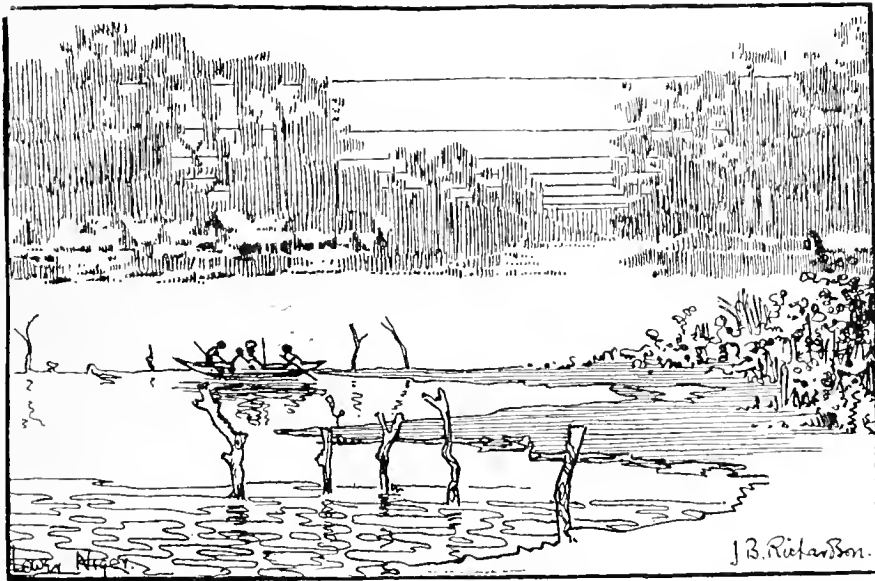
a ship's officer shouts to you to get out of the way, the crew bump into you, and everyone, down to the bugler, worries you for tips. But at last you see all your kit piled on the deck of the river-boat, probably with the things most wanted underneath, mixed up with a crowd of screaming excited niggers. Then you clumsily climb over the side and board the stern-wheeler, damp and perspiring, sad to leave the last link with home, but relieved to be settled with just your own belongings all ready to hand.

The little river-steamer, like a glorified punt with a house of cards on top and paddle-wheels out of all proportion behind, casts off and chugs away in the rain to a misty grey mass of low buildings and wharves, passing close by the awful mangrove swamps that seem to be the realization of some part of Dante's inferno, with the slimy tentacled roots and the inky ooze below, suggestive of evil and loathsome forms of life.

The line of buildings looms larger and larger through the rain, and slowly resolves itself into Burutu, the commercial port of this part of the delta, where the Niger Company's pallid clerks ceaselessly check and consign thousands of kernels and kegs of palm-oil to the factories in England, so that those at home may be well supplied with soap. If you are fortunate enough to be at Burutu in the day-time you will discover what a tremendous amount of articles you must have to make yourself comfortable on your journey up river, and you will probably spend a small fortune, with the help and advice of the excellent salesmen in the stores, on household articles, many

pans, which clink and rattle and kick up as much noise as their owners' voices.

In great contrast to these are the crafty-looking Hausa and Nupe traders, in their long embroidered gowns and turbans, spending their time in silent meditation or at intervals ostentatiously praising Allah, gabbling Arabic prayers, of which they do not understand a word. Then there are servant-boys going up-river to look for work or returning to their homes, peasant men and women who have been down to the big stores for supplies, small local native traders returning with their rolls of cloth and cheap goods from Europe, families migrating to towns higher up the river,



ON THE LOWER NIGER.

of which you will afterward find useless and throw away. Again at Burutu you are bombarded with boys looking for work, and traders trying to sell curios at absurd prices. Here the lower deck fills up with its queer mixture of black humanity; the civilized natives, in unnecessary spectacles, gaudy blazers, second-hand topees, and much polished boots, making themselves objectionable with their high-pitched voices, covert insolence, and lazy air; their female belongings in rainbow-coloured clothes from Manchester, inharmoniously arranged, gathered together; their quaint, solemn-eyed offspring, poor little infants with bulging stomachs and big heads, some dressed in little European frocks or suits, the majority quite naked; and the women never without a huge collection of cheap enamelled pots and

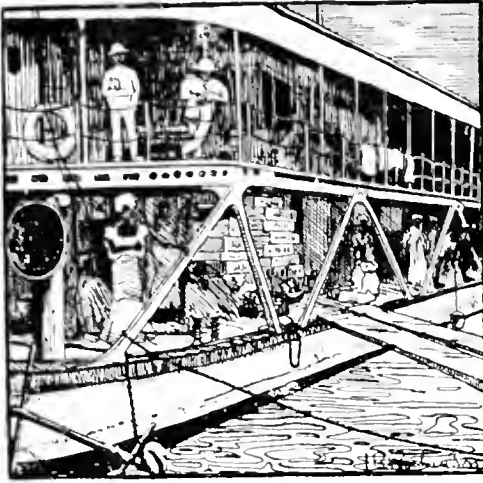
and a general filling of the flotsam and jetsam of black humanity.

All these make up the native passengers, who from the Christy Minstrel clerk to those garbed in nothing but an unclean towel (a toilet often absurdly finished by an umbrella or cap) are chattering nineteen to the dozen, bursting into inane laughter, and quarrelling as hard as they can, grouped lazily, with their food and household goods mixed up with the European passengers' packing cases, and whatever cargo and livestock is on board.

The native passengers are invariably bullied abominably by the crew, who in turn are bullied by the boatswain, usually a loquacious individual, and all are looked down upon by the superior native engineer, who sometimes even goes so far as to argue with the skipper, the

wonderful being who somehow rules over this mixed crowd and keeps it in a semblance of order.

The native skippers and pilots of the steamers that ply up and down the Niger are to be



En Route.

greatly respected for their skill and behaviour. Whether it is that they have imbibed in the past some of the spirit of the British captains who discovered and investigated these waters, or whether it is that they are a peculiar race, it is a fact that they rarely lose their heads in a crisis, and, unlike the average negro, show the calm poise that one expects of a ship's captain. This, together with the instinct that allows them to follow the ever-shifting channel of the river, makes them—for the work in hand—much preferable to a white man.

After a little while the mangroves and the delta scenery generally become monotonous, with the everlasting line of dark-green trees only relieved by the occasional tin-roofed German or English trading station or the passing of a down-going steamer. But, on the second day, the main river is reached, a broad placid stream with low banks and numerous villages. The shed-like dwellings that form these villages, with their palm-leaf thatch, built in a long, straggling line broken by banana plantations and towering palms, always with a *ju-ju* post surmounted by some quaint effigy or flying a pennant in the centre of the village, stand out in strong colours and hold relief against the dark foliage of the forest trees.

Nature is kind to these villagers, for the river teems with fish, the palms and plantains provide all their physical needs, and it would

seem that they have no use for clothes. For a shilling it is said a native can buy here enough bananas to feed him for a week—two huge bunches—and fish is to be had for the trouble of casting a hook.

The pastime of all the native youth is to paddle into mid-stream to the passing steamers in their little dug-out canoes, and dive for bottles, old tins, or small coins. They never seem to fear the crocodiles, which are by no means scarce, for unless it is their time to die the native belief is that no crocodile will touch



Boys Diving.

man, and, even then, that the crocodile that does kill man is no ordinary reptile but half-human.

The river approaching Onitsha is nearly a mile broad, the low banks are covered with towering palms and splendid trees in gorgeous blossom, masses of crimson and white.

Onitsha, the first important stopping place, is the biggest station on the lower Niger, and is a town of many years' standing, with a considerable European population. The first

thing that catches the eye as the boat draws near is a large sign telling the passenger that he may CABLE should he desire. Here too you meet with the first hill, a low one, sloping steeply to the river. It is on this hill, north of the town, that the hospital and many of the bungalows are built, separated from commer-

ripe strawberries and cream, and a pithy centre not unlike banana.

Up to Onitsha it is easy to live solely on provisions brought off the Elder Dempster boat, but what with the climate, dishonest boys, and the appetite engendered by sea air, it is usual to have to start there to open tins and live on the country. There is the tale of a ham, expected to last almost to Lokoja, that mysteriously disappeared in the night and almost caused a state of civil war on the boat. The servants in a body accused the ship's steward, who swore he had seen one of the boys (whom he did not hesitate to name) eating the ham at the ship's side at the dead of night. Whereupon the whole native population on

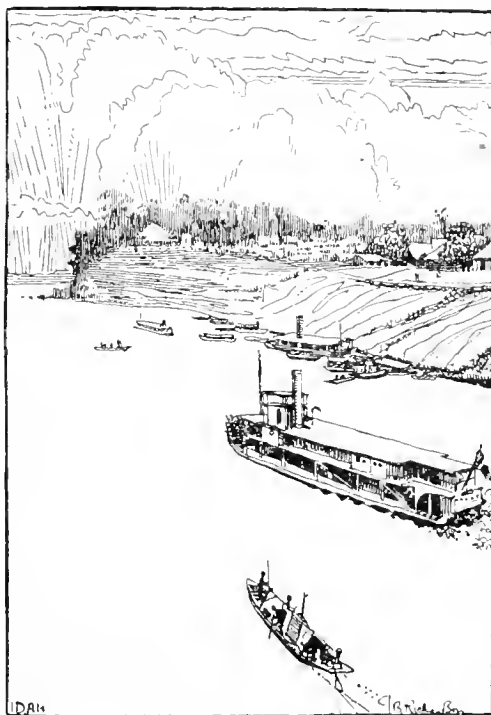


The Market, Onitsha

The Market, Onitsha.

cial Onitsha and the native town by a suspension bridge, where the cable sign hangs over a small creek.

The steamer is moored here for some time, and the native passengers hurry to the market place to replenish their stock of provisions and to exchange gossip, while the European lands to stretch his legs and stroll along the well-made roads and gaze in admiration at real English lamp-posts along the river side. Here the servant-boys go to the market to get fresh fruit and poultry, and the native bakers come alongside to sell you white bread at an exorbitant price. In an hour or two the inhabitants of the lower deck and your boys come back, your boys with very little change, measly fowls or ducks, eggs, and a curious collection of fruit: mangoes, which are delightful, but best eaten in a bath, and green oranges, quite sweet, belying the colour of their skins. Also one curious fruit they may bring, soft and luscious, the size and shape of a small marrow, dark-green, with the inside pulp tasting of un-



IDAII.

board divided into two parties—the one supporting the steward, led by the chief engineer, excitedly brandishing a large spanner, the other by a large and bad tempered Lagos cook, armed with the implements of his trade. For a time it seemed from the pandemonium as if a paltry ham-bone might cost several lives, but European intervention happily averted such a calamity by threatening to inflict the most awful pains and penalties on both the suspects, who doubtlessly fraternized in cursing their white masters.

Soon after Onitsha the river becomes attractive, dotted with little islands and little bright sandy bays among the fringe of reeds. The palm-trees diminish and almost disappear, giving place to a forest much more homelike, so that long reaches of the stream here look for all the world like the Thames near Runnymede, and not strangely tropical at all. At night also it is disappointing to find that the moths that gather round the lamp are rarely remarkable for size or colour, most of them being of just the same species and size as those found in England.

It is at night that the life on the river-boat is both at its best and worst. In the early evening, just after dinner, while still steaming onward, it is at its best. Imagine a big house-boat lit by electric light, slowly advancing up a broad and stately river, a table in the forward deck-space with coffee and liqueurs, a gramophone playing pleasant music, the cool night breeze driving away the heat and odours of the day, and comforting a group of well-fed men. True, it sometimes rains, and then you will seek your bunk early, perhaps only to be greeted by a steady drip from the roof. In fact, in one sternwheeler it is said there is only one place in which to sleep during the 'rains,' and that is under the mess-room table, and even that has the disadvantage of being abominably draughty. Still, on the whole, if the rain keeps off or the boat is in good repair, the hour or so before tying up for the night is the best of all.

Later in the night you experience the boat at its worst, when all the lights, except the riding lights, are out, and everyone has settled down, the Europeans in their bunks and the natives rolled up in blankets and cloths, completely covered against the flies, lying in heaps and rows, looking like a collection of corpses laid out for hasty burial. But they are unlike corpses in the constant exasperating mumbling chatter, broken at intervals by a cackling laugh or a spell of so-called music, always with the interminable chanting accompaniment of the millions of frogs on the bank. The musician produces so irritating a tinkle that you are sure to get up from your fitful slumbers and call your boy, who, after you have awakened the whole ship's company by shouting for ten minutes, will sleepily answer "Sah! Sah!!" You tell him to threaten the player with murder, or you may even confiscate the instrument, the worst of which is like a glorified jew's harp, 2½ ft. broad, in the shape of an over-bent violin-bow, but someone is sure to start again just as you have dropped to sleep. Next

day you will most probably find that it is your own boy who was playing most of the time.

One of the most virulent of the many pests on board an up-going boat is the begging native clerk, who, trusting to the innocence of the newcomers among the white men entering the country, sends begging letters setting forth his misfortunes and stating his grievances in no half-hearted way, always winding up his curious screed by an appeal for money for food, clothing, or his family.

The scenery becomes monotonous at times, but it changes pleasantly as the boat approaches Idah. The banks becomes steeper and more defined, the forest becomes less dense and the clearings correspondingly larger, until Idah itself is reached, where there is quite a large stretch of well-cleared ground, with numerous tin-roofed stores close to the landing-stages, naturally the ordinary arrangement at a depôt of the Niger Company or one of the other big trading firms. Although they certainly are not pretty, these bare square sheds, their usefulness to both the white man and the black compensate largely for their ugliness as a feature of the landscape.

Idah is built on a low ridge, which ends abruptly at the riverside in staring red cliffs. Here you first find a good native market; a large open space, surrounded by grass huts and sheds, under which, in gourds and neatly woven baskets and mats, men and women offer a curious collection of commodities; native-made cloth from Kano and brightly coloured prints from Manchester; all sorts of food-stuffs, from balls of dirty-looking brown dough, made of guinea-cornflower, to lumps of sugar at ten a penny; cigarettes and beads, charms and medicines, all laid out for inspection; with butchers and tailors, leather-workers and barbers all adding to the variety and noise, the butcher especially, for he or one of his assistants beats a tom-tom with great and never-ceasing vigour, easily out-distancing the noise of the pavement butchers in the poorer parts of London with their ear-piercing "Buy! Buy!! Buy!!!"

The disgusting bald vultures, the chickens, and the yellow-dog, a whippet-like animal and a bigger cur than any of his kind, all scavenge together, sharing the butcher's leavings and waste corn. Together these three form the native sanitary authorities of Nigeria.

As the steamer leaves Idah, the gleaming line of red cliffs stands out, and for many miles of the river forms one of the best landmarks in the course of the Niger. Soon the country becomes more broken; the character-

istic flat-topped hills of Northern Nigeria, often beautiful in profile, begin to line the banks. The approach to Itope is made particularly fine by them. The long flat hills, one behind the other, merge into the distance, gently sloping down to the distant river, so that the distant reaches are hidden and give the broad stream the appearance of a long and winding lake surrounded by slopes covered in green, with now and then a patch of red ironstone peeping through, and the fringe of splendid forest lining the shores.

Above Itope, and not far below Lokoja, there are cotton plantations, the scenes of

Gold for India.—According to the yearly report on the production of gold throughout the world, issued by Samuel Montagu & Co., the output during 1912 is estimated at £98,000,000, being an increase of £4,000,000 over the figure for 1911. The total import of gold into India during 1912 is estimated at £27,800,000, a sum equal to 28 per cent of the world's output. The reason for this large import into India is stated to be the uninterrupted prosperity following on a succession of excellent rainy seasons. Consequently, the same import may not necessarily be expected in succeeding years. However, whatever the



I TOPE.

energetic enterprise on the part of firms from Manchester and elsewhere in the north of England. On these plantations a single white man, or perhaps a couple, will control a few hundred natives and as many acres of cleared forest. Here they spend a solitary existence, perhaps for several years, with the sole recreation of coming to the river-bank and perhaps seeing and greeting other white men in passing boats. Soon after leaving one of the largest of these, Lokoja comes into view.

(To be continued).

The Tin Output of Nigeria in November is given as 638 tons of concentrate averaging about 65% metal.

future may be in connection with general prosperity, the Indian trader has recently become aware of the steadiness of the price of gold as compared with that of silver, and from this point of view the expectation is that Indian demand for gold will continue. Messrs. Montagu's report contains much interesting information relating to the uses to which gold is put in India. For instance gold leaf is swallowed for medicinal purposes, though the scientific reason for such an application is obscure. An inquiry as to the ultimate use of certain shipments of several thousand sovereigns revealed the fact that a Rajah had the taste to use them as centre pieces for each pane of glass in the windows of his palace, and each pane was a small one.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Dec. 1912	Nov. 1912	Dec. 1911
£75. 12s. 2d.	£77. 0s. 0d.	£61. 3s. 11d.

December seldom exhibits great activity in the copper trade, as consumers endeavour to reduce their stocks for 'window-dressing' purposes, and speculators prefer to be level during the holiday period. This year the grave political anxieties of Europe, and the fears of tariff revision in America have assisted to depress the prices of standard copper. We have accordingly seen a fall from £78 to £74. 7s. 6d. for three months' copper. The selling quotation of American producers has, however, been kept steady at 17 $\frac{3}{4}$ cents and £82 for electrolytic. Fears have been expressed freely that refiners would be forced to accept lower figures, but there has been no sign of wavering, and the position has developed into a struggle of endurance between them and the consumers. Their policy appears to have been successful. A sale of 10,000 tons to the Steel Corporation at 17 $\frac{3}{4}$ c. has been announced, and since then they have forced some European buyers to pay £82. This result has not been achieved without sacrifice, for extensive purchases of standard copper on the London market appear to have been made with a view to stimulate demand, resulting in a recovery to £78. At the same time electrolytic copper has been shipped to European warehouses to prevent undue accumulation on the other side, and this accounts for the increase shown in the figures for the end of December. Manufacturers show themselves to be short of supplies, and have been calling for delivery of their purchases with feverish insistency. But they still continue to purchase with extreme caution, with the dread of further political complications hanging over their heads.

TIN.

Average prices of cash standard tin :

Dec. 1912	Nov. 1912	Dec. 1911
£226. 17s. 8d.	£227. 16s. 10d.	£203 7s. 2d.

This metal has been consistently strong throughout the month, having been little influenced by unfavourable factors, although the level of prices must be considered high. Speculative engagements appear unusually light and consumptive demand is unabated. Demand comes chiefly from America, where they have been buying direct in the Straits, and so have deprived bears of ammunition for attacks

on the London market. After the holidays, demand became urgent. The Dutch Government announces that next year's Banca sales will be 900 tons more than at first intended.

SPELTER.

Average prices of good ordinary brands :

Dec. 1912	Nov. 1912	Dec. 1911
£26. 0s. 4d.	£26. 14s. 3d.	£26. 13s. 7d.

There is little to report in connection with this metal. Demand is good, but after last month's buying movement the trade is well supplied and prices have been kept steady. The holidays have no doubt contributed to prevent any considerable movement. Buyers everywhere are reported busy.

LEAD.

Average prices of soft foreign lead :

Dec. 1912	Nov. 1912	Dec. 1911
£18. 1s. 6d.	£18. 4s. 7d.	£15. 13s. 4d.

Prices were maintained steadily at or about £18. 2s. 6d. until quite the end of the month, when, support being withdrawn, prices relapsed to £17. 15s. Demand is quite satisfactory for the time of year, and indeed the inquiry for early delivery has been quite a feature. The arrivals from Australia have been large, yet no selling pressure is observable. Now that stock-taking is over, a livelier trade is expected. At the more reasonable level of prices that we have reached, a broadening in demand is not unlikely. The syndicate of blue lead makers in Germany has been dissolved, and an open market made for their manufactures. As consumers have withheld their purchases awaiting this event, more active business is expected in that direction. It remains to be seen whether this will be sufficient to check the downward tendency.

OTHER METALS AND MINERALS.

Prices quoted on January 10 :

SILVER.—29 $\frac{1}{2}$ d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £88 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£38 to £40 per ton.

QUICKSILVER.—£7. 7s. 6d. per flask.

MANGANESE ORE.—10d. to 1s. per unit.

IRON ORE.—Cumberland hematite 26s. 6d. per ton at mine. Spanish 23s. delivered in England.

PIG IRON.—Cleveland 68s. per ton. Hematite 82s. 6d. per ton.

WOLFRAM ORE.—33s. per unit (1%).

VARIATIONS IN ASSAYING AT THE ALASKA-TREADWELL

By W. P. LASS.

DURING the months of April, May, and June, 1912, special attention was paid to the work of assaying the Treadwell ores. More than 500 special assays were made for the sole purpose of determining the chance of error that enters into each determination, and what degree of accuracy would be considered satisfactory for the three different grades of ore: the mine-samples and mill-feed, the concentrate, and the tailing.

To summarize the results of the following

ings in a 100-mesh screen, there are at least 5,348,811 particles; if one of these particles be fine gold, it would increase the assay result \$1'12 per ton. The extent to which one of these particles of free gold may influence the accuracy of the assay can be estimated by a consideration of the size of the mesh-opening through which the sample passed.

For example, consider a 40-mesh screen, having openings of 0'3734 mm. This cubed equals 0'05206 cu. mm., which multiplied by



GASTINEAU CHANNEL, WITH TREADWELL ON THE SHORE.

tables, the average variation of one assay from another on mine and mill samples, averaging \$3'46 per ton, was 41'3%. The average variation of one assay from another on tailing samples, averaging 32'7 cents per ton, was 20'6%. The average variation of one concentrate sample from another, averaging \$68'79 per ton, was 7'6 per cent.

Being called upon to account for the above variations, my conclusions are: The gold occurs in Treadwell ores as free gold particles, associated with barren rock. There are at least 280,000 particles in one assay-ton of 40-mesh sand. If one of these particles be fine gold it would increase the gold content of the ore \$21'52 per ton. In one assay-ton of cubic particles of the same dimensions as the open-

2, the specific gravity of sand, equals 0'10412 mg., this being the weight of one cube of same dimensions as a 40-mesh screen-opening. One assay-ton contains 29,166 milligrammes; this when divided by 0'10412 gives 280,119 as the number of particles in one assay-ton of ore, when in the shape of cubes of the same size as a 40-mesh screen-opening. Again, 0'05206 multiplied by 18'38, the specific gravity of gold, equals 0'957 mg., the weight of one cube of gold of the same dimension as the opening in a 40-mesh screen. \$18'60, the value per ounce of Treadwell gold, multiplied by 0'957 equals \$17'80, the deviation in dollars per ton caused by a gold cube of same dimensions as the opening in a 40-mesh screen, when in excess or deficit to one assay-ton sample of sand.

A 100-mesh screen has an opening of 0.1397 mm., which when cubed equals 0.0027264 cu. mm. in one cube of the same dimensions as an opening in a 100-mesh screen. This 0.0027264 multiplied by 2, the specific gravity of the ore, equals 0.0054528 mg., the weight of one cube of ore passing 100 mesh. The 29,166 mg. in one assay-ton divided by 0.0054528 equals 5,348,811 particles of ore in one assay-ton, when in the form of cubes of the same size as an opening in a 100-mesh screen. Again, 0.0027264 multiplied by 18.38, the specific gravity of gold, equals 0.0501 mg., the weight of one gold cube passing 100 mesh. \$18.60, the value per ounce of Treadwell gold, multiplied by 0.0501 equals 93 cents, the deviation per ton caused by a gold cube of the same dimensions as an opening in a 100-mesh screen, when in excess or deficit to one assay-ton sample of sand. The greater the variation in value between the particles the greater is the error; for instance, a \$1 particle when added to the value of the mill-feed varies the result a great deal more than when added to the concentrate. The variation in assays on the mine-samples and mill-feed is greater than the variation in tailing-samples, and this is accounted for by the fact that the free gold is high in the former and is to a great extent removed from the latter.

The sample of concentrate averaging \$68.79 in gold was crushed to pass a 120-mesh screen, two fusions of 1/2 assay-ton each were made for one determination or assay.

The following is a fair representation of the results that are obtained in ordinary practice from 10 different samples, all unknown to the assayer.

Number of Sample	First assay	Second assay	Variation
1.....	40.10	43.41	3.31
2.....	61.60	64.08	2.48
3.....	60.98	67.80	6.82
4.....	38.45	41.34	2.89
5.....	65.74	64.70	1.04
6.....	116.38	107.29	9.09
7.....	137.05	147.39	10.34
8.....	67.18	59.33	7.85
9.....	65.12	60.57	4.55
10.....	35.55	31.83	3.72
Average.....	68.81	68.77	5.21

The variation is 7.6%, figured on the average of the 20 assays and the average variation.

The following table represents the results obtained in ordinary practice on 28 different mine and mill samples all unknown to the assayer. The samples were cut down by the

most approved automatic samplers and the final pulp was crushed to pass a 100-mesh screen, one fusion of one assay-ton being made for each assay.

Number of Sample	First assay	Second assay	Variation
1.....	5.58	6.41	0.83
2.....	0.83	1.45	0.62
3.....	11.78	12.86	1.08
4.....	1.24	2.89	1.65
5.....	0.83	1.03	0.20
6.....	4.96	9.30	4.34
7.....	0.20	1.41	1.21
8.....	6.41	8.06	1.65
9.....	0.62	1.24	0.62
10.....	2.69	3.51	0.82
11.....	6.41	2.07	4.34
12.....	2.27	2.89	0.62
13.....	2.27	2.89	0.62
14.....	0.62	0.83	0.21
15.....	6.20	1.24	4.96
16.....	3.51	3.93	0.42
17.....	3.31	3.93	0.62
18.....	5.78	1.65	4.13
19.....	4.96	4.55	0.41
20.....	3.72	3.51	0.21
21.....	2.89	2.89	0.00
22.....	6.20	2.89	3.31
23.....	1.86	1.45	0.41
24.....	2.69	2.89	0.20
25.....	1.03	1.86	0.83
26.....	1.45	2.07	0.62
27.....	2.27	3.93	1.66
28.....	5.37	1.86	3.51
Average.....	3.50	3.41	1.43

The variation is 41.3%, figured on the average of the 56 assays and the average variation.

A point of special interest is that though the average variation may be great, the average value of all the samples remains approximately the same. It is a compensating variation.

The tailing from the mill averaging 32.7 cents was crushed to pass an 100-mesh screen and the assay-value reported upon four fusions of 2 1/2 assay-tons each, was as follows:

Number of Sample	First assay	Second assay	Variation
1.....	28.9	26.9	02.0
2.....	16.5	35.1	18.6
3.....	24.8	33.1	8.3
4.....	33.1	31.0	2.1
5.....	41.3	35.1	6.2
6.....	18.6	26.9	8.3
7.....	37.2	33.1	4.1
8.....	37.2	35.1	2.1
9.....	34.1	24.8	9.3
10.....	53.7	47.5	6.2
Average.....	32.5	32.9	6.7

The variation was 20.6%, figured on the average of the 20 assays and the average variation.

ANCIENT MINE-WORKINGS.

By T. LANE CARTER.

THERE is this difference between the artist who stands before the masterpieces of antiquity and the engineer who contemplates ancient mine workings. In the first instance the modern sculptor must acknowledge that his art does not surpass that of the old Greeks. But the engineer who looks at the silver mines of Themistocles, near Athens, and compares them with the mines of Michigan or the Rand, can feel that we have advanced since those old days. It has been my privilege to stand on the Acropolis of Athens and to see the marbles of Phidias, to look at the silver mines of Themistocles, and, speaking as an en-

gineer, I must confess to a feeling of superiority over the old Greeks. In other words the owners of ancient mines always wish to make them as old as possible, for age means romance, and romance is frequently a great aid in raising capital for mining ventures. Probably for this reason in Mexico they try to prove that the ancient workings were mostly made by the Aztecs, and in Rhodesia that the mines were successfully started by King Solomon, and not by the Portuguese adventurers of the Middle Ages.

The skill shown by the old workers in overcoming their difficulties is often admirable. In countries where slavery prevailed, mineral wealth was no doubt won at an enormous sac-



AN ANCIENT ORE-CARRIER.

gineer, I must confess to a feeling of superiority over the old Greeks.

Those who have seen ancient mine workings have been impressed with the romance and mystery that gathers round these deserted holes in the ground. They seem to follow a well known law of physics so far as the increase of value with age is concerned. We are all acquainted with the law of inverse squares. Heat for instance varies inversely as the square of the distance. So do the values of ancient mine workings, in the estimation of the public. If we represent the value of some old holes 100 years old, by one, then the value of these holes, if it can be proved that they are 200 years old,

rifice of life. Fortunately for us, modern pumps were not known in those days. Had not the ancients been driven out by water, it is probable their operations would have reached many hundred feet deeper. The problem of hoisting the ore would have been solved, for greater depth would have meant only more slaves and more lives.

The method of mining varied in different parts of the world. In the *antiguas* (or old mine workings of Spanish colonies) the rock was frequently soft enough to be worked with picks and wedges. In Rhodesia the rock was generally hard and one sees there occasionally the evidence of how the Solomonites or Portu-

guese, or whoever made these holes, broke the rock. On the hanging wall of an old mine in Rhodesia there was found by the pioneers a covering of soot several inches thick, which had been made by the fires used by the ancients to heat the rock to be broken. After the rock had been raised to a high temperature the fire would be drawn away and water would be thrown against the face. This so chilled the stone that it cracked off and the miners then carried the gold-bearing material in small bags on their backs up to the surface, where the precious metal was extracted. In these close underground passages, where fires were lighted

away, for there are no signs of old dumps or smelting works. Possibly these copper carbonates were used in the trade of the day as a paint, not to decorate the wall of a king but to adorn the faces of native belles and young warriors. Many of the old stopes and holes are now caved in. In some of the open excavations large trees are growing. Over some of the openings roots of trees have interlocked and form a net-work so that earth has collected and grasses have grown. Such places are dangerous. I was standing on the top of the old workings one day at a point that I considered perfectly secure, when the ground gave way

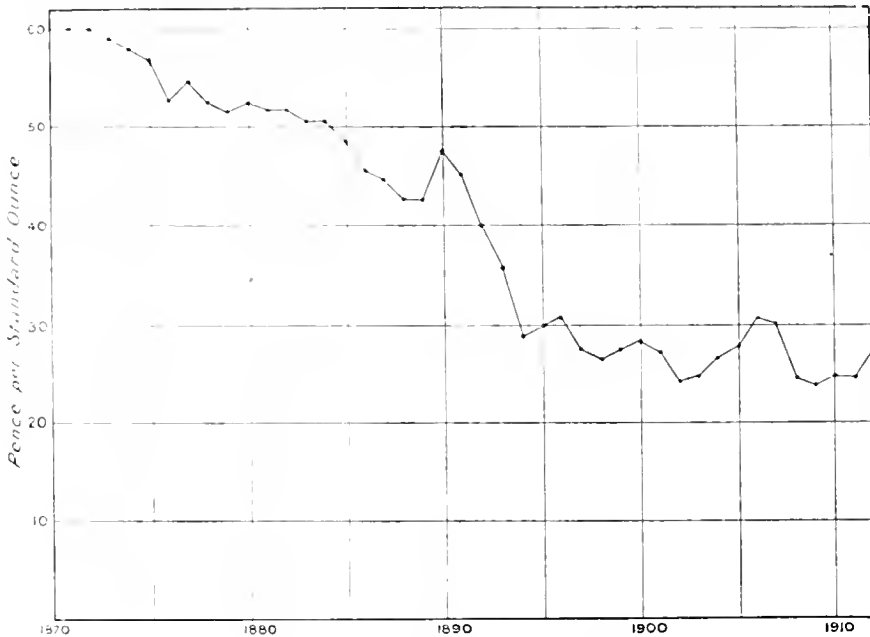


Fig. 1. THE FALL IN THE PRICE OF SILVER.

to heat the rock, the loss of life from bad ventilation must have been enormous. But slaves were cheap in those days and this was a more profitable way of killing your enemies than running a sword through them in battle.

When they speak of ancient mine workings people generally picture a gold mine, but in Rhodesia I have seen interesting workings made on copper and iron deposits. One of the most interesting old copper workings is that of the Bwana M'Kubwa mine in northern Rhodesia, near the Congo Free State. This mine promises to become a successful producer, after an idleness of possibly hundreds of years. A large tonnage of carbonate ore had been taken out from a vein that averaged about 18 ft. in width. The material was probably carried

and I fell. Instinctively I threw out my arms and held my head above ground. Under my feet I could feel nothing, and realized that I was swinging in mid-air at the top of an ancient stope. Fortunately the natives had a rope, which they lowered to me. When I got on solid ground I threw a lighted torch into the hole and found that if I had fallen I should have landed on some sharp boulders one hundred feet below.

On one place on the vein we found a cave twice the size of an ordinary room, from which the old miners probably extracted some high-grade carbonate. The walls were covered with carbonates of copper, and it was stated that a large bunch of high-grade ore had been found. Further investigation, however, showed that the deposit on the walls was superficial, formed

by the evaporation of the water that for generations had seeped into the cave.

The remains left by the ancient iron workers in Central Africa are most interesting. How old these little furnaces are, or the holes from which the iron ore was extracted, no one can say, but it is certain that for hundreds of years 'the iron age' has existed in Central Africa. When I began to know Spanish America and to study ancient mine workings, I remembered the evidences of the iron age that I had seen in Central Africa, and could not help thinking that a page of history would have been written differently had the 'iron age' really existed in Peru and Mexico when Cortez and Pizarro

and ore at twenty miles an hour to and from great depths in the earth.

Mexico has some of the most ancient mine-workings in the world. Promoters have been as eager to assert that these old workings were mines of Montezuma as men in other parts of the world have tried to prove that their mines once belonged to King Solomon. You have no idea how often thousands of dollars of stock in a new Mexican company has been sold, after an eloquent address by the president of the company, stating that they had after long search found out where the Aztecs got their wealth,

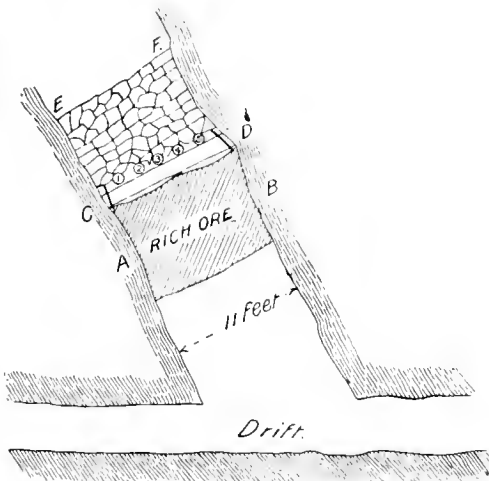


Fig. 2. A Mexican Antiqua.

with their pirate bands overthrew the civilizations of these ancient peoples. The reason that Cortez and his cruel adventurers overcame Montezuma and his armies, was that the Spaniards were armed with iron and steel cannon, while to the Aztecs iron was unknown, an ignorance that proved fatal when their bronze weapons clashed against the steel swords and armour of their adversaries.

Anyone who crawls through ancient workings, studying the incrustations of the walls deposited there from solutions that have evaporated, will feel thankful that he did not mine in the olden times. Then it was a disgrace to be a miner, and the profession of a mining engineer was only fit for a slave. While pitying the lot of the miserable human beings who made these excavations, we realize that on their work and experience modern mining is built. Out of the ladder and bucket has gradually been evolved the winding engine, which whirls men

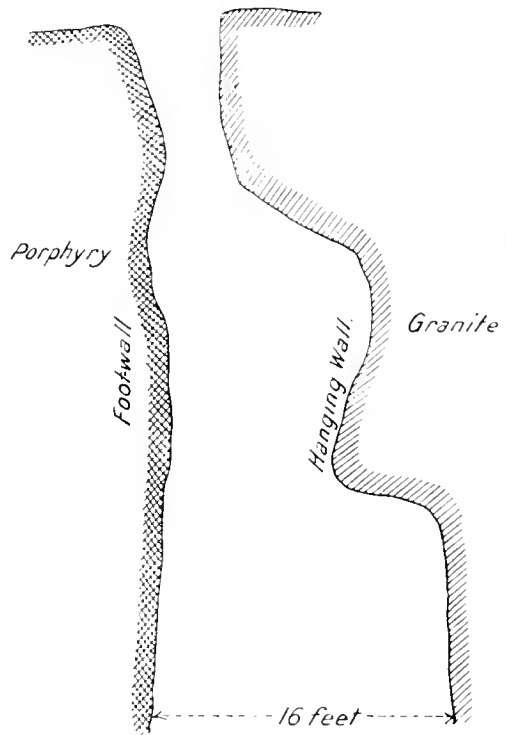


Fig. 3. Old Workings.

and for that reason had determined to call the company the Montezuma Gold and Silver Mining Company. In many cases the gentleman may have been perfectly honest in his belief that the *antiguas*, which constituted their mine, would prove of great value in depth. Being a man with no mining training or experience, he was not able to judge the possibilities. So many people have got into trouble through these ancient workings that it is about time to state that a series of holes in the ground does not prove that there is a mine underneath. There are a number of points to be considered in this connection.

In the first place, we have no records to show the profit and loss account on the tonnage taken out by the ancients. In most cases labour was cheap, and they might have worked at a loss for a long time, hoping eventually to strike a bonanza.

Then too we have no idea of their working cost in those days. Of one thing we are certain, and that is that labour was far less expensive than now, and in some cases it is doubtful if we can work more cheaply on a small scale, even when we employ machinery.

Then again when considering the value these mines had in the past, especially in Mexico, attention should be given to a condition shown graphically in Fig. 1, which gives the fluctuations in the value of silver. The drop in the price of silver since 1870 is one of the most striking facts in the history of metals. The miner producing silver from an *antigua* in Mexico in 1902 received about 52 cents per ounce for his product, while a price at least double was given to the ancient worker. In these days of cheap silver, when the dollar or the five-shilling piece is despised, we do not appreciate the feeling of awe with which people looked upon silver in the middle of the last century, when it was worth 5s. 6d. or \$130 per ounce. An old gentleman in Chicago told me he well remembered that when he was a boy the school-master brought eight new silver dollars to the school and showed them to the scholars as curiosities.

We frequently make a mistake in not giving the ancient workers full credit for their skill in mining and metallurgy. We are inclined to think that they worked only fabulously rich ores. This is a mistake. Of course, they found bonanzas, just as we do today, but the average value of their output was not as high as the imaginative mind of the public supposes. It is true some great mines have been found beneath old workings, but there have also been some bitter disappointments. All that I wish to bring out is the fact that one must use caution and make a thorough examination of *antiguas*, not jumping to the conclusion that these old holes with a romantic past will lead to a fortune every time.

It is surprising how extensive the Mexican *antiguas* are, especially in a mountainous country where wide veins of silver-gold outcrop. In that country I have seen cavern leading into cavern, from which hundreds of thousands of tons of ore have been taken, some by the Aztecs and more by the Spaniards. These old miners selected the ore, and left in the stopes thousands of tons of stuff that was too low-grade

for them, but which is readily taken out and treated in these days of the cyanide process and high extraction.

In an *antigua* in Sonora, Mexico, I noted how the ancient miners took out a pillar in a stope. This is shown in Fig. 2, where AB is a pillar of rich ore that is to be robbed. Pieces of stout timber, CD, were firmly placed against the pillar AB. Then lagging as at 1, 2, 3, 4, 5, 6, was laid across the timbers, and loose rock, EF, was piled against the pillar, AB. Rich ore in the pillar was then taken out through the drift. Before they succeeded in getting all of this ore away they must have been frightened, for a little of it still remains. The pack-wall, however, has set so firmly against the 'hanging' that it is almost as effective as the pillar AB would be if it had remained. This work was probably done by early Spanish miners.

At times one can get a good idea of the eccentricities of vein formation in these old workings. In Fig. 3 I give an example. In this case the lode was valuable enough to warrant the removal of everything from foot-wall to hanging wall. This does not happen often. As a rule the old workers have gone through these veins extracting the higher grade material only, and in looking at their handiwork, one is reminded of the operations of a mole.

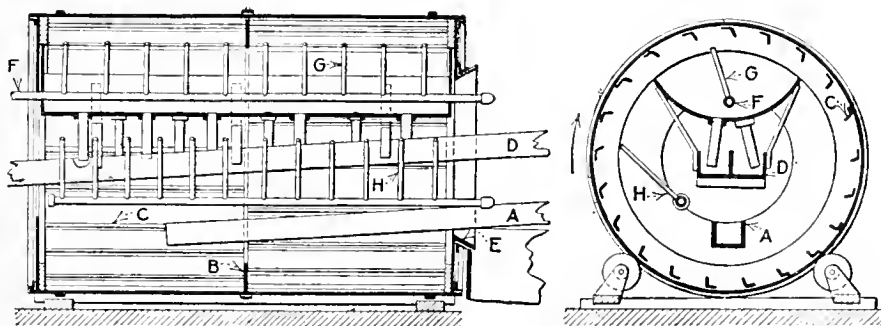
From time immemorial these ancient mine workings have been shrouded in myth and superstition. It was not without reason that the miners of the Harz peopled the mines with malicious gnomes and prayed to St. Nichol and St. Cobold before descending into the depths. In Mexico around every *antigua* extraordinary stories have grown, especially if the holes were dug by Aztecs. These, of course, make the amount of the precious metals, said to have been extracted, simply fabulous. Tradition has it that in some of these *antiguas* the miners were buried by the caving of the hanging wall. In such cases it is common to find that the natives believe the workings to be haunted by the spirits of the men killed many years ago. In one case the present-day workmen broke into the old stopes and found skeletons of victims buried in a mine accident. In this case the tradition was founded on fact.

The ancient mine workings can be of great service to the engineer if he will use his common sense and not allow romance to blind him. The fact that thousands of tons of ore have been extracted in the past is an excellent sign, but not a conclusive one that much ore still remains. The engineer should use the same caution and care in investigating an *antigua* as he would employ in opening up a new mine.

PRÉCIS OF TECHNOLOGY

Major's Classifier.—In our last issue we gave some figures relating to the performance of low-speed Chilean mills used for crushing gold ore at the plant of the Minnesota company at Maitland, South Dakota. At this plant a new type of classifier has been introduced by Edmund Major, the metallurgist in charge. This is described in the *Engineering and Mining Journal* for November 23. The machine consists of a drum, which revolves at $1\frac{1}{2}$ to 2 revolutions per minute, with openings at each end for feed and discharge, and divided into two or more compartments by circular ribs. In the illustration there are two compartments, separated by the rib *B*. Longitudinal ribs *C* are fixed on the interior of the drum. The pulp is introduced through the launder *A* into the first left-hand compartment. As the drum revolves, the pulp is agitated by the ribs *C*, which finally catch the coarser sand and carry it upward. As the ribs rise, the sand in them is washed by sprays *H*, and subsequently re-

All varieties of banded ironstone contain primary quartz as an essential constituent, although the amount may be small. It is confined to layers running parallel with the banding of the rock, and is distinct from the veins and patches of secondary quartz frequently found especially in regions of shattering. This secondary quartz is usually glassy, while the primary quartz of the bands is dull and flinty. The commonest variety of the rock consists of alternate layers of flinty quartz and dull brown oxides. Occasionally, near granite contacts, the primary quartz has been given a glassy character. As regards association of gold with quartz, the author's experience is that auriferous secondary quartz tends to become rapidly impoverished with depth. On the other hand, the gold found in the bands of iron oxide is more persistent. In prospecting the ironstone, care must be taken in panning, for as the gold is very fine it is apt to be lost. It is not clear as yet whether the gold in the ironstone is always a surface enrichment or not, for in some notable cases the lower part of the orebody has been much



MAJOR'S CLASSIFIER.

moved by sprays *G* into a trough, from which they are discharged into one or other compartment of the launder *D*. The finer material passes over the partition into the right-hand compartment of the drum, in which the longitudinal ribs are set in a different way, so as to catch everything that is not slime. The sand that is thus caught is raised and discharged into the other compartment of the launder *D*. The slime overflow is discharged through the opening *E*. The machine in use at the Minnesota treats material ground to pass 30-mesh, and produces (1) coarse sand that is re-ground, (2) fine sand for leaching, and (3) slime for agitating. It measures 6ft. in diameter by $7\frac{3}{4}$ ft. long, and treats over 200 tons of solid per day. The cost of construction and maintenance is low, and the amount of power consumed is small.

Banded Ironstones of Rhodesia.—In the *Rhodesian Mining Review* for November 13, F. P. Mennell commences a series of articles entitled: 'Practical Notes on Some Rhodesian Ore Deposits.' The first article deals with orebodies found in the banded ironstones. A large share of the attention of prospectors has been given to these rocks, and in several cases important gold deposits have been found in them that were not known to the ubiquitous 'ancient.' On the other hand the rocks occurring in a great many localities carry too small a content to be of any economic value. The author has sampled this class of deposit in practically every district of Matabeleland and Mashonaland, and has been able to deduce certain generalizations as to the nature of these auriferous ironstones.

richer than at the surface. Some bodies have exhibited great enrichment at the surface and have been of low grade below, while others have yielded nothing but ore of average grade throughout. The chances are that lodes formed in the vicinity of granite contacts are more persistent in depth than elsewhere. The alteration in the characteristics of the banded ironstones at the water level is much marked, so much so as to make many prospectors believe that they have got into a different formation. The change to sulphides is not always immediate, for in many cases the red and brown oxides give way first to magnetite, especially near the granite. The sulphides near the granite consist largely of pyrrhotite, and often arsenopyrite. Wherever arsenical sulphides are present, the oxidized zone above contains scorodite.

We quote the author verbatim in his summary of promising features: "Generally speaking, as will be inferred from what has already been said, the most promising deposits seem to be those in which the gold is fine and not intimately associated with vein quartz. Rise of values where the iron is in greatest quantity seems on the whole a good sign, but at the same time it is not usually the variety of the rock which is almost solid iron ore that seems most often to turn out workable. Very jaspersy ironstone does not usually carry gold. All the same, it does not do to neglect sampling any kind which is at all likely to be mineralized. Greenish copper stains are perhaps to be regarded as a good indication. Proximity to the granite is a favourable feature. As regards the characters of the rock in bulk, occurrences with a fairly

straight course along the surface are not only easiest to follow underground, but appear to be most consistent in value. Provided the gold is there, the harder the rock, or less altered and broken up, the better appear to be the chances of a deposit in it proving valuable."

Concentrating Tin Ore.—At the December meeting of the Institution of Mining and Metallurgy, W. Fischer Wilkinson read a paper giving his views of the efficiency of present methods in vogue in Cornwall for concentrating tin ores, and suggesting means for improvement in practice. During the two years of his occupancy of the principalship of the School of Mines at Camborne, Mr. Wilkinson conducted many experiments on concentration. Part of his paper was devoted to a discussion of the relative merits of vanning and chemical assay, and this contained nothing new. On the other hand, his remarks about coarse and fine crushing draw attention to an aspect of the subject too often neglected.

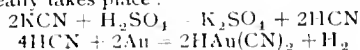
Mr. Wilkinson's experience is all in favour of much coarser crushing than at present in vogue. At Dolcoath, a 30 mesh screen is still used, but at some of the newer plants coarser screens have been introduced. At the South Crofty mine, for instance, the mesh nowadays used is 14. At the King Edward mine, belonging to the Camborne School, the author used a 4-mesh screen, and sent the whole of the discharge over a Buss table. The concentrate thus obtained contained 42% of the cassiterite in the ore and assayed 32% metal. The first middling was screened and the oversize crushed, and the whole sent to an upward-current classifier. The second middling was screened, the oversize rejected as being of too low grade, and the undersize sent to the same classifier. The slime and fine sand were sent direct to the classifier. This classifier dealt with about 84% of the original weight of the ore, and 56% of its original metal content. It separated the material into slime and sand, the former being treated on round tables, and the latter on Frue vanners. Owing to incompleteness of the plant, the further recoveries were not as great as they otherwise might be, so that the paper cannot be taken as the full results of successful practice. But it will serve its purpose in drawing attention to numerous views and ideas worthy of discussion and further experiment.

The Gitsham Cyanide Process.—In our November issue we gave a short reference under 'Current Literature' to the modification in the cyanide process introduced in Australia by J. Gitsham. A discussion of this process appears in the *Mining and Scientific Press* for November 23, written we expect by M. W. von Bernewitz, late of Kalgoorlie, and now on the staff of our San Francisco contemporary. The writer says that this new variation of the cyanide process is attracting a good deal of attention in Australia. He quotes the *Journal of the Chamber of Mines of Victoria* as follows: "A subject of interest to the mining community is the process of the Gitsham Gold Extraction Co. It is claimed for this process that it will extract gold from refractory materials where the cyanide process has wholly or partly failed. Antimony and copper ores are readily treated by the solvent, which is a weak solution of hydrocyanic acid. The company has treated at a profit about 4000 tons of material at Costerfield, Burke's Flat, and Clonbinane, which has been a stumbling block to many cyaniders. Experimental work on pyritic tailing from various parts of the Commonwealth has shown excellent results, a notable case being tailing from Randall's, Western Australia, which needs no comment. Unlike the cyanide solution, the Gitsham solvent is a weak acid,

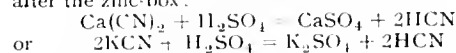
and it is claimed that owing to this fact material can be treated by leaching which otherwise would require agitation. The percentage of regeneration of the solutions, it is stated, is high, and averages from 40 to 50% of the chemicals used. The company claims that, given on ore partly amenable to the cyanide treatment, their process will give an increased extraction at a lower cost; and even on clean material the costs of chemicals are less, the only exception being on ores containing carbonates of lime, and so far this difficulty has not been overcome. As this type of material is very rare, it is not a serious matter. The control and testing of the solvent is soon learned by the man of average intelligence. The company has been doing experimental work for the past eighteen months, and is now open to the criticism of the metallurgical world."

He also quotes the following supplementary details given in a recent issue of the *Kalgoorlie Miner*: "The process consists of the use of an acid solution formed by the combination of potassium cyanide and sulphuric acid, giving rise to hydrocyanic acid. Its strength varies from 0.05 to 0.1%, and is worked on the same system as ordinary cyanide. The solutions are allowed to percolate in the ordinary way, but before passing through the extractor box they are drawn off into a solution of lime-water, which regenerates the cyanide and makes the solution ready for precipitation. Should the solutions be used in the weak state, a little cyanide is added at the head of the zinc-box and the solution brought up to about 0.08%. After passing over the zinc the solutions are again made acid and applied to the ore.

"The following equations show what the inventor believes really takes place:



after the zinc-box:

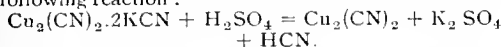


"The metallurgist of the company claims that all copper ores, likewise antimony, bismuth, and arsenic, are insoluble, and do not affect the solution and its selective action for the precious metal. Even the most refractory copper carbonate, with mixed oxides, has been successfully experimented on. About four thousand tons of ore, containing antimony and copper, have been treated by this process for a yield of £1600 worth of bullion, of an average value exceeding £4 per ounce.

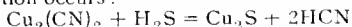
"Although very delicate, the process is easily controlled by a chemist, the important feature being the combination point of KCN and H_2SO_4 . Some ores have quite enough acidity to generate with the cyanide the acid. When the latter is in excess it is removed or neutralized. Where not present, the use of sulphuric acid is resorted to. The inventor (Mr. Gitsham) claims to be able to treat ores which have before not been amenable to the cyanide process. Costs are from 3 to 6s. per ton on the most refractory types. The process has been patented in the principal countries of the world, and the shareholders have decided to raise the additional capital necessary to introduce it in mining fields outside the Commonwealth. With this object in view, G. Gitsham and T. H. Davies are shortly leaving for London. As far as Australia is concerned, the company announces that they are prepared to deal with mine-owners on a royalty basis."

The suggestion recently made by W. D. Williamson, in a communication to the *Journal of the Chemical, Metallurgical, & Mining Society of South Africa*, is of interest in this connection. Mr. Williamson states

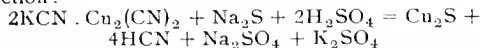
that the addition of sulphuric acid to a solution containing the double cyanide of copper will cause the following reaction :



The insoluble copper cyanide can be separated by filtration, and the filtration neutralized by a slight excess of alkali. It is obvious, however, that there is still cyanogen in the copper precipitate which ought to be recovered if possible. If the precipitate be suspended in water, and treated with hydrogen sulphide, the following reaction occurs :



The solution resulting from filtration of the mixture can then be neutralized with alkali and used as solvent for fresh ore. The two reactions can be combined by adding sodium sulphide and the requisite amount of acid to the cupriferos cyanide solution, with this reaction :



The precipitated copper cyanide carries down with it the precious metals, and can be collected, dried, and shipped to the smelter. The clear liquor is then neutralized with a slight excess of alkali to combine with the free HCN.

An obvious drawback of both of these processes is that any attempt to neutralize an acid sulphate solution by the addition of milk of lime will cause the formation of a copious precipitate of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, which occludes considerable quantities of cyanide and which is too fine grained to permit filtering and washing unless the solution is kept cold and allowed to stand several days during precipitation. Since the hydrate of calcium is only slightly soluble in water, being less soluble than the sulphate, any attempt to neutralize in this way would greatly dilute the cyanide solution. It might prove feasible, however, to use dried or ground slaked lime for neutralizing, drive off and collect the HCN gas, and allow the sulphate solution to run to waste, or to otherwise modify the process so as to reduce it to a better working basis.

Sulphatizing Copper Ores.—The December *Bulletin* of the American Institute of Mining Engineers contains a paper by Utey Wedge, describing the work of his roasting furnace in connection with the production of copper sulphate direct from copper ores whether sulphides, carbonates, silicates, or oxides. The question of extracting copper by wet methods is engaging the attention of metallurgists in America, where many deposits are at present lying neglected on account of the scarcity of fuel and absence of flux. Mr. Wedge has been able to regulate his furnace in such a way as to produce a large proportion of sulphate of copper; and by adding iron pyrite to oxidized ores, to make the latter amenable to the same treatment. Previous investigations have ascertained the various reactions of roasting copper ores, and the temperatures at which they take place. Copper sulphide, CuS , decomposes into Cu_2S and sulphur, at temperatures above 350°C . From that temperature to 500°C , the Cu_2S is converted into oxide and sulphate, while at a still higher temperature it is decomposed with the formation of oxide of copper. Other sulphides containing copper behave differently, but the above gives an idea of the general tendency. In roasting for the production of a copper compound soluble in water (sulphate), the formation of oxide of copper is the chief obstacle to overcome. The presence of iron sulphide assists in sulphatizing the copper oxide formed. At temperatures below 600°C , some iron persulphate is formed, which at temperatures above 530°C roasts to Fe_2O_3 and SO_3 . The

latter may combine with the CuO to form CuSO_4 , or the copper oxide may react direct with the persulphate with the production of Fe_2O_3 and sulphate of copper. The portion of iron sulphide that roasts to Fe_2O_3 is of some assistance in sulphatizing the oxide of copper, as at a temperature between 500° and 750°C , the iron oxide acts as a catalytic agent for the transformation of sulphur dioxide to sulphur trioxide, which latter in turn tends to combine with the copper oxide to form sulphate. Mr. Wedge, acting on these principles, has conducted a large number of experiments on a variety of ores, and he gives the results in his paper. One of the most interesting was with a low-grade copper silicate assaying 1.86% copper and 2.79% iron, with only a fraction of sulphur, and most of the gangue silica. An addition of 6% of iron pyrite was made and the mixture roasted. The resulting material contained 95% of the copper in soluble form. Leaching could be done readily, with 1 ton of water to 1 ton of ore, and the solution so obtained could be used on successive charges until a strength of 15% CuSO_4 was reached. At this point the iron content was only 0.1 per cent. The general results obtained by all these experiments indicate that this means of securing a sulphatizing roast promises to be of economic importance.

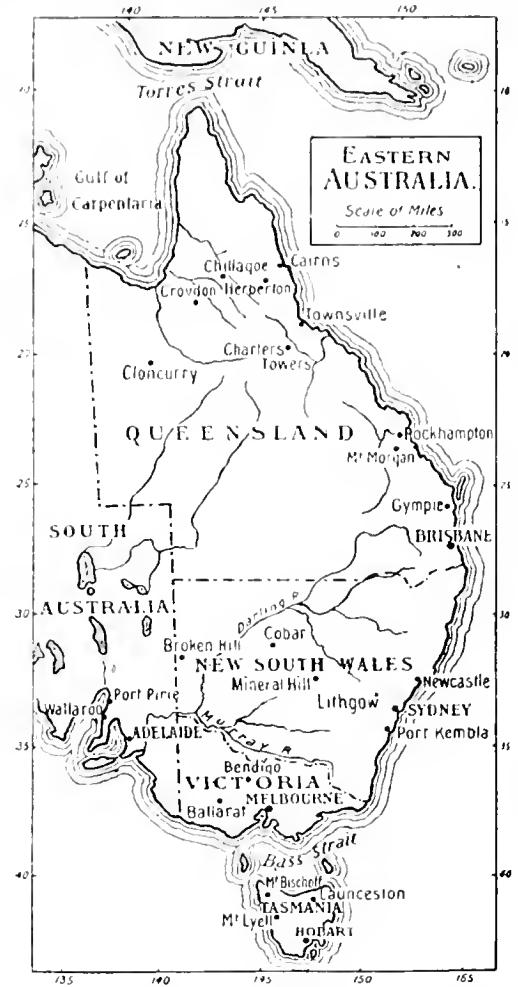
Cyanidation of Slime.—Prompted by the recent judgment in the United States, the effect of which is apparently to throw all filter processes under a Moore master patent, the *Engineering and Mining Journal* in its issue of November 30 discusses alternative processes for removing auriferous solutions from slime. The article mentions that, for some time, and quite irrespective of this judgment, many cyanide metallurgists have been dissatisfied with filter processes, owing to the high cost of installation and operation, and have proposed, and in some cases adopted, the decantation system once more. Such plants as have been erected recently on the old principle employ a very different process from the old original decantation, and, in fact, employ the continuous process involving successive thickenings and dilutions, a number of strengths of solutions being used, the lowest being extremely dilute and practically barren. Where water is plentiful and where weak solutions can be used, it is possible to employ the continuous decantation process without filters, but where stronger solutions are required, as is the case with silver ores, the filter must be used as an accessory.

The *Mining and Scientific Press*, in its issue of December 14, discusses the New York paper's proposal, and shows the limits of the applicability of decantation to slime, arguing that such an alteration of practice would be reactionary and atavistic. We quote the views of our San Francisco contemporary at length. The first great step in successful treatment of slime was the application of filtration to the problem. Fine material may be treated by decantation, but filtration introduces notable economies. The reason, as also the limitation to successful application of decantation, is not difficult to see when the behaviour of finely ground material in solutions is analysed. There is more pore space in a fine mud than in coarse sand settled in water, but the spaces between individual solid particles are narrower. It follows that the channels or openings through the mass are smaller and more tortuous. The mass is less permeable, and to obtain the same rate of flow extra force of some sort must be given to the liquid material which it is proposed to pass through the mass of solid particles. In settled sand the open spaces are sufficiently large to permit gravity alone to pull solutions through the mass at a rate that makes

commercial results possible in treatment plants. With slime, to obtain the same rate of flow requires a vacuum or pressure. The proposal to obviate this difficulty by continuous agitation and decantation has been made many times, and plants designed on this plan are in successful operation treating finely ground material that is really a sand. In them the individual particles are kept freely floating, each completely surrounded by solution, and never allowed to completely settle. As a result, there are no pore spaces, and the particle rather than the mass becomes important. The plan is ingenious and there is a field for such treatment plants, but not a universal one. The reason lies in the difference in specific gravity between sulphides and silicious particles. The very ores that most need sliming for successful treatment are those in which the gold and silver is locked in the sulphides. It is to release this gold and silver that the ore is slimed. In practical operation of treatment plants where concentrate is cyanided, it is universally true that the sulphides are found to require more time for treatment than the other material. The relations of the valuable to base metal are closer, and complete solution of the gold and silver is harder to obtain. In continuous agitation and decantation, the first particles to settle are sulphides, and with them goes much of the gold and silver. The result is that the material which should receive the longest treatment really escapes from the system first, and there seems no general way to avoid this without completely destroying the process itself. The old process of decantation is available for coarse material; continuous decantation can be used on coarse and finer material and is useful for taking off the richer solution before vacuum filtration. For slime the best treatment is by filtration, and for general use the adoption of decantation would be a backward step, however helpful it may be in special cases or in combination with filtration.

Sorting at Surface.—The decision of the metallurgists of the Consolidated Gold Fields to abolish the sorting of ore at surface at Knights Deep draws attention again to the relative advantages of close sorting as against large tonnages of lower grade ore. The *South African Mining Journal* for November 30 and December 7, discusses the question in detail in its application to the new policy at Knights Deep. As we record in our "Company Reports" this month, this mine is essentially a low-grade one. The extraction is only 17s 5d per ton milled, and the working cost is 11s. 6d. A few months ago the Simmer East was absorbed. For some time these mines have had a joint mill containing 400 stamps, 270 being used by Knights Deep, and 130 by Simmer East. The whole of the 400 together with the 9 tube-mills is now under one control, and the plant now ranks as the fourth in size on the Rand. In October over 100,000 tons was crushed. There were only three other companies to exceed this figure: Randfontein Central 217,089 tons, Crown Mines 167,800 tons, and East Rand Proprietary 148,500 tons. But from the point of view of gold output, Knights Deep ranked only 11th with £81,981. Four mines, the Ferreira Deep, Robinson, New Modderfontein, and Village Main Reef, exceeded this output, though treating less than half the tonnage. The monthly capacity is now being increased to 120,000 tons, by the addition of two more tube-mills. Sorting at surface has never been largely employed, but a great deal of discard has been employed for packing. The great width of the deposit does not afford much scope for surface sorting. At the Simmer East the ore is of different character, for the main gold-carrier is a thin and rich grit, and more harm than good is there-

fore done by sorting at surface. It is estimated that sorting to reject 3000 tons per month would cost £300, while the cost of milling it would be only £90; but this of course is not the real economic gauge. Our contemporary presents figures to show that as the average grade decreases so does the percentage of waste rejected. Possibly the argument should be stated the other way round in some cases, though it cannot be doubted that in more cases, especially in deep levels, the ore is nowadays of uniformly low grade, and con-

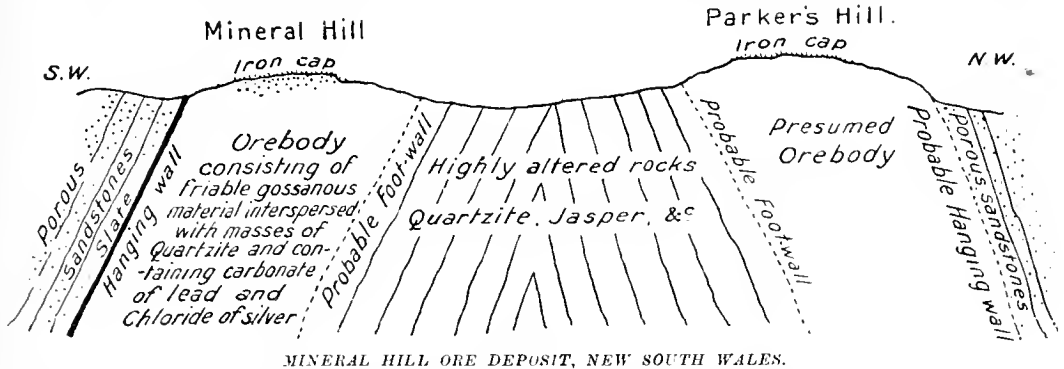


sequently the average content would not be substantially increased by more vigorous sorting. In looking through the returns by various companies, it is clear that the largest amount of sorting is done by the companies with the highest-grade ore. It will thus be seen that the abolition of sorting at a low grade mine is not due to an unreasoning big-tonnage craze. Our contemporary is on the side of the big mill, the abolition of sorting, and the consequently prolonged life of the mines, having at heart the continued prosperity of the great South African community, rather than the interests of European shareholders whose only desire is to reap as big profits as possible in the shortest time.

Mineral Hill Silver-Lead Deposit.—In the November issue of this magazine, our Melbourne correspondent gave a few details relating to the silver-lead deposit at Mineral Hill, New South Wales, or 'Iodide' as it has since been re-christened. As this deposit promises to be of great importance, we quote herewith from a report made by E. F. Pittman, appearing in the *Australian Mining Standard* of November 7. Mineral Hill is situated almost in the centre of New South Wales, 40 miles north of Condobolin, and 120 miles southeast of Cobar. The map on the opposite page shows the position. The hill itself is one of small elevation, and it consists on the surface of hard rocks, chiefly iron-stained quartzites and jaspers. In places the iron oxide predominates to such an extent as to form a limonite ore, and the whole structure is in fact a characteristic iron cap. When the first prospecting shafts were sunk in 1908, blue and green carbonates of copper were found, together with some galena, and parts of the surface gossan assayed as high as 65 oz. silver. Some shipments of copper ore were made, but as no continuous body was discovered, operations were suspended. In the subsequent year

showed lead varying from 20·8 to 41·6%, silver from 21·4 to 125·4 oz., and gold from 0 to 10 dwt. After all smelting and freight charges had been deducted, the amount received totalled £9313. Naturally the ore shipped was picked from the richest parts, the parts of lower grade being either left standing or placed on the dumps for future consideration. Condobolin is the nearest railway centre, and no doubt a connecting line will eventually be constructed. In that case Lithgow coke would be available and smelting could be done on the spot.

The rocks in which the deposit occurs consist of gritty sandstones and slates, probably of Devonian age. From 10 to 12 ft. of slate is usually found on the hanging wall, and above are porous sandstones. In the orebody itself these have been changed to hard and dense silicious rocks, such as are found in the outcrop, as already mentioned. On the eastern and northeastern side of the hill, the rocks are highly metamorphosed, having almost the appearance of felsites. The cause of this metamorphism has not yet been discovered. Further to the northeast is another hill with an iron cap, and if reliance can be placed on the present



MINERAL HILL ORE DEPOSIT, NEW SOUTH WALES.

another shaft was sunk, this time on the southern side of the iron cap. Here a friable oxidized ore was found below the cap, containing varying proportions of carbonate of lead and chloride of silver. As the shaft was continued, it became evident that an important silver-lead orebody had been discovered. Interspersed among the friable ore are large masses of quartzite which contain some silver. The deepest working is at 90 ft., where a drift has been carried 300 ft. in the direction of the longer axis of the orebody, and a cross-cut has been driven from the hanging wall for 116 ft. in the direction of what is supposed to be the shorter axis. The cross-cut is still in ore, but of comparatively poor quality, though as the content varies considerably throughout the present workings, there is a probability of finding richer ore again. Mr Pittman is of opinion that the breadth may eventually prove to be from 170 to 200 ft. As regards irregularity of content, some of the assays have been as low as 4% lead and 2 oz. silver, while others have been as high as 42% lead and 1000 oz. silver. Gold is also found in places, and several shipments have assayed from 2 to 10 dwt. per ton. The exact form of the orebody has not yet been determined, for the strike of the hanging wall, which dips at 60°, varies considerably from west to northwest. Thus the true direction of the longer axis is uncertain. At the time of Mr. Pittman's report, October 28, 1274 tons had been shipped to the Cockle Creek smelter, in 16 lots varying from 13 to 154 tons. The assays of these, according to the smelter returns,

interpretation of the surface geology, there is every reason to believe in the existence of another large orebody. A shaft has been sunk at the southwestern side of the cap and has not disclosed anything of value. Mr. Pittman considers that this is the wrong place to sink, for there is a strong probability of the orebody dipping in the opposite direction, as shown in the accompanying sketch. It seems certain that at Mineral Hill a most important discovery has been made, perhaps the most important in Australia for several years.

CURRENT LITERATURE.

Diamond Mines of Kimberly.—In the *Engineering and Mining Journal* for November 9 and 16, J. T. Fuller, at one time manager of the Dutoitspan, describes the methods of mining in use at the Kimberly diamond mines.

Black Oak Cyanide Plant.—In the *Mining and Scientific Press* for November 30, C. H. Urquhart describes an all-sliming cyanide plant, the first of the kind to be erected on the Mother Lode, California.

Cyanidation in Korea.—In the *Mining and Scientific Press* for November 23, A. E. Drucker describes the latest additions to the cyanide plant at the mines of the Oriental Consolidated, Korea.

Yuanmi Gold Mine.—The *Monthly Journal* of the Chamber of Mines of Western Australia for October describes the treatment plant erected at the Yuanmi mine, West Australia.

Metallurgy at Nipissing, Cobalt.—In the *Engineering and Mining Journal* for December 7, R. B. Watson describes the Butters process for the cyanidation amalgamation of the high grade silver ores of Cobalt. This plant was described by T. A. Rickard in the issue of this magazine for June last.

Cyanidation at Porcupine.—In the *Engineering and Mining Journal* for November 23, Herbert A. Megraw describes the cyanide plant at the Dome mines, Porcupine. In the issue of December 21, he describes the Hollinger cyanide plant.

Electrically Refining Bullion.—In the *Mining and Scientific Press* for December 14 and 21, Harold French gives an historical account of electrolytic methods of parting gold and silver, in special application to the work done at the San Francisco mint.

Estimating Acid in Smelter Gases.—In the *Engineering and Mining Journal* for November 23, F. G. Hawley, chemist at Cananea, describes a direct method of determining the amount of SO_3 in smelter gases.

Alumina in Copper Slags.—The *Canadian Mining Journal* for November 15 contains an article by James Buchanan and F. E. Lee describing their experience with alumina in copper slags. The article is in the nature of a discussion of H. C. Bellinger's presidential address to the Australasian Institute of Mining Engineers, an abstract of which was given in our issue of August last. Their experience is that the amount of alumina acting as a base is determined by the amount of lime present in the slag.

Ore-Shoots in Depth.—The *Mining and Scientific Press* for November 30 contains the second article by F. Lynwood Garrison on the decrease of value in ore-shoots in depth.

Wolframite in Portugal.—The *Mining and Scientific Press* for December 14 contains a translation by F. L. Hess of F. Bronckart's article in the *Annales de la Société Géologique de Belgique* on the wolframite deposits of northern Portugal.

Laterite in Rhodesia.—In the *Rhodesian Mining Review* for November 27, F. P. Mennell describes the laterite deposits of Rhodesia, and discusses their mode of origin.

Iridium in America.—The *Engineering and Mining Journal* for November 9 contains an article by F. W. Horton, on iridium and platinum found in Trinity river, California.

New Zealand Coal.—In the *Colliery Guardian* for November 22, A. Gordon Macdonald commences an article on the brown-coal deposits in the neighbourhood of Otago, New Zealand, and presents a review of the modern methods of utilizing fuel of comparatively low grade.

British Coalfields.—The *Colliery Guardian* for January 3 publishes a map of the exposed, hidden, and presumed coalfields in the British Isles.

Coking at Low Temperatures.—Bulletin 60 of the University of Illinois Engineering Experimental Station deals with the manufacture of coke at low temperatures and with the by-products obtained. In this country, coalite is being made in this way, but little technical information has been divulged; the bulletin is therefore of timely interest.

Waihi Power.—In the *Mining and Engineering Review* for October 5, W. Wilson describes the Hora-Hora hydro-electric power station now being built for the Waihi gold mine, New Zealand.

BOOKS REVIEWED

Round the World for Gold. By Herbert W. L. Way. Cloth, octavo, 350 pages, illustrated. London: Sampson, Low, Marston & Co. Price 21s net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is a type of book becoming rare. It is the story of *voyages métallurgiques* of the kind that Humboldt rendered illustrious. Presumably such books are less numerous because the keeping of diaries is foreign to the modern man, who is in too much of a hurry to record his impressions as he traverses the globe. The newspapers and the magazines have torn the glamour from the remotest corners; the facilities for travel are so plentiful that the recondite has become almost commonplace. In order to succeed therefore in the writing of such a book of travel, the author must not be *blasé*; he must respond readily to his changing environment, he must have eyes for the very things that the globe-trotter passes in weary disdain. A travel-book must be ingenuous if it is to be interesting. Such is Mr. Way's volume. As a mining engineer he managed or inspected mines in Colorado, Western Australia, the Philippines, Siam, China, and West Africa. Before engaging in mining he lived for a while as a 'rancher' in Western Kansas. In the early part of the book he describes the follies and brutalities, the ineptitude and the recklessness, of a colony of young Englishmen transplanted, without taking root, in the prairies of the Great West. The colony at Wichita played the fool and called it 'farming.' Mr. Way evidently was out of sympathy with such a performance and soon migrated to Colorado, where, at Ward and Rico, he showed that an educated man can do the manual work of a miner without degradation. Subsequently, as surveyor and superintendent, he shared many sorts of experience, and cut the wisdom teeth of a mining engineer. He tells of people and places well known to the reviewer, who can testify to the correctness and faithfulness of his descriptions. Even a few typographical errors (especially in proper names) do not lessen the reviewer's confidence in the essential accuracy of the recital. Good proof readers are rare.

The chapters on Western Australia reflect faithfully the vagaries of the boom, as seen in 1896. Coming fresh from Colorado, Mr. Way was well prepared to appreciate the difference between a mine and a hole-in-the-ground, between business and spoofery. To the reviewer this part of the book has a melancholy interest by reason of frequent references to Reuben Rickard and Alfred Rickard, brothers and mining engineers, both of whom died during a campaign of inspection in Western Australia. A friendly, and just, tribute is offered to the experience and sound sense of the elder brother, one of the few engineers that injected some degree of sanity into the speculative orgy at Coolgardie, Kanowna, and Hannan's (now Kalgoorlie). Mr. Way was assistant to the younger brother, and on his death returned to London, preparatory to his journey to the Philippines. These impressions of the boom in Western Australia may be epitomized by the story of the elderly Cornishman at the Miriam mine, who, on being asked to show some gold in the ore, burst out laughing: "It's gold you want to see, is it? Not many people care about gold out here so long as there is a quartz reef. There ain't enough gold in this mine to make a pair of spectacles for a skeeta (mosquito)." This is not the first time that people have witlessly or wittingly disregarded the fact that it is the gold, not the quartz, that changes 'rock' to 'ore.'

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

In the Philippines, Mr. Way sampled several prospects and saw the beginning of the Spanish-American war. His notes are to the point. Among others is a description of ancient workings and equally ancient methods. At the Ancla de Oro mine, the natives were crushing the ore in arastras made of blocks of quartz, then grinding the crushed ore "by hand to an impalpable powder between two large smooth quartz stones," and finally washing this powder "in small pans made from half a coconut shell." The Tagales when working for themselves "are quite satisfied if they earn from one to two reals [1 real = 2½d] a day; but if they work for wages they expect four reals, about ninepence a day." This suggests why mines exploited by natives may be profitable to them, and yet prove unprofitable to foreign companies.

Then to Bangkok and Kabin, and thence to Watana, in Siam. Here Mr. Way penetrated into the very heart of the tropical jungle. He describes the fauna and flora, varying the account with personal experiences, of a most varied nature. The indomitable character of the exploring Britisher is a cause for wonderment, especially to those who stay at home. The Kabin gold mines seem to have been of some good. Mr. Way remained there as manager for two years. Numerous tests of the river gravels indicated the possibility of profitable dredging.

After that he went to China, to examine mineral prospects on a concession in the upper Yangtse. Here, as elsewhere, he varied mining with shooting. His experiences as an inspector were humorous. When a supposed coal discovery proved to be a peat deposit, the Chinese broker explained: "Just now belong little young coal, by and by little more old, get all the same hard coal." Again, he was shown a supposed gold mine, as indicated by a limestone bluff on the smooth face of which was cut a pair of immense doors, on the panels of which was an inscription in Chinese signifying that these were the portals to great wealth in gold and silver. By aid of his interpreter, Mr. Way used language suitable to the occasion. As he says later: "The Chinese had showed me mica for silver, pyrites for gold, and shale or peat for coal." Meanwhile he shot pheasants and collected snuff-bottles. He examined the oilfields of Tzu-liu-ching and Lui-hua-chi, where several thousand boreholes had been sunk by the Chinese to depths of 1000 to 2000 ft. in search for brine, the oil being regarded as a nuisance. Later he saw a promising mineral region in the province of Szechwan. Gold, copper, and lead deposits are described, notably the Maha gold mine. At this time the Boxer disorders rendered a sojourn dangerous to foreigners, so Mr. Way, with Dr. R. L. Jack, had to make his exit from China through Burma. He had an adventurous journey to Mandalay. This part of the book gives a good deal of valuable and interesting information concerning the extreme southwestern corner of China. It appears to be a fine country, likely to prove an important mineral region.

Next, and last, as far as this book tells, Mr. Way went to West Africa for the Prah syndicate, which had options on various pigs in pokes on the Gold Coast. He had the usual experience, except as regards health. Fortified by experience and good sense, he escaped the fevers and other ills rampant in the jungle, but his story includes references to several less fortunate than himself. The book ends abruptly. We find ourselves wishing that it continued. Mr. Way writes without pretence, with the style that is the man, simply and naturally. Numerous excellent photographs adorn the volume, which also contains what is essential to a book of travel, namely, maps. The book was worth writing

and it is well worth reading. It is a notable addition to the literature of mining.

T. A. R.

Geology of Soils and Substrata.—By Horace B. Woodward. Octavo, 370 pages, illustrated. London: Edward Arnold. Price 7s. 6d net. For sale at the Technical Bookshop of *The Mining Magazine*.

On several occasions we have referred in this column to the excellent series of applied geology published by Edward Arnold. Among them Thomas and MacAlister's 'Geology of Ore Deposits' holds a high place, as does also Mr. Woodward's book on the 'Geology of Water-Supply.' It can hardly be doubted that the geological study of agriculture is of equal importance and that this application of the science must be of interest to the geologist. The extraordinary fertility of the virgin loams and loesses in the United States tended to stunt the geological study in that part of the world; nevertheless G. P. Merrill's book on the formation of soils from rocks, published in New York, has been the best that has hitherto appeared. Nowadays the search for deposits of mineral manures, and of substances that can be treated for their manufacture, is keen, and soluble phosphates are one of the important by-products wherever sulphuric acid is made. Similarly the search for soluble potash salts, and for methods of manufacturing them from igneous rocks, is receiving the special attention of chemists and geologists. It is obvious therefore that a book such as this will be welcomed by a large circle of students. Naturally the book is English, and most of the instances are drawn from the British Isles.

Interbasaltic Rocks of Northeast Ireland. By G. A. J. Cole and others. Paper boards, 140 pages, with maps and illustrations. Dublin: Geological Survey of Ireland. Price 3s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This book, which is one of the Memoirs of the Geological Survey of Ireland, deals with the iron ore and bauxite deposits found between two series of basaltic rocks in the north of Ireland. These deposits have been described from time to time, but no thorough geological examination has been made since the aluminium industry was developed, until the new survey was organized two years ago. This has added much valuable information. Recent research as to laterites and allied deposits in other parts of the world throws much light on the origin of the Irish iron and aluminium ores.

Winding Engines and Winding Appliances. By George McCulloch and T. Campbell Futers. Cloth, octavo, 450 pages, with many illustrations and working drawings. London: Edward Arnold. Price 21s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The only book hitherto published dealing exclusively with hoisting plant for mines is that by H. C. Behr on winding plants for great depths, forming a special volume of the Transactions of the Institution of Mining and Metallurgy. That book was limited in its scope and treated only one phase of the subject. Also it was highly mathematical, and presented a formidable appearance to the average practical engineer. Much has been done in connection with electrical winding since those days. The authors of the new book are specialists on mine machinery. Mr. McCulloch is government inspector of machinery to the Department of Mines, Western Australia; while Mr. Futers requires no introduction in this country as a writer on the mechanical engineering of mines.

In the introductory chapter, the various systems of winding are outlined, and the general calculations given. Chapters 2 to 7 elaborate the details of design of the various systems of winding by steam. Chapter 8 deals with winding from great depths, and chapter 9 with colliery winding engines. Chapters 10 to 12 are devoted to electric winding plant, and chapters 13 to 20 to accessories, namely drums, brakes, clutches.

Antimony-Mining Industry in New South Wales.

By J. E. Carne. Octavo, paper boards, 60 pages, illustrated. Sydney: W. A. Gullick, Government Printer. Price 2s.

This is No. 16 of 'Mining Resources,' prepared by the Geological Survey of New South Wales. Though antimony is widely distributed in that state, little mining can be profitably done. In the preface it says that, when the next rise in the price of the metal occurs, Mr. Carne's information will be useful. This rise has since arrived, so the book appears at an opportune moment.

Fuel Resources of California.—By M. L. Requa, F. W. Bradley, and Walter Stadler. Pamphlet, 36 pages. San Francisco: The Commonwealth Club.

This is a timely account, by thoroughly competent engineers, acting in the public interest, of the oil, gas, peat, and coal deposits of the State of California. The statistical, geological, and general economic information is given in a succinct and convenient form. Copies can be obtained gratis through *The Mining Magazine*, or from M. L. Requa, Crocker Building, San Francisco. T.A.R.

Chemical Arithmetic and Calculation of Furnace Charges. By Regis Chauvenet. Cloth, octavo, 300 pages. Philadelphia and London: J. B. Lippincott Company. Price 18s. For sale at the Technical Bookshop of *The Mining Magazine*.

This book consists of two separate sections. The first covers weights and measures, specific gravity, elementary mensuration, atomic weights, chemical formulae, vapour density, calculation of analyses, volumetric analysis, etc. The second is devoted to the calculation of furnace charges, and presents the principles in a more suitable way for the young student than the standard books by Peters, Hofman, and J. W. Richards.

A Treatise on Mine-Surveying. By Bennett H. Brough. Cloth octavo, 370 pages, illustrated. London: Charles Griffin & Co. Price 6s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

For over a year this standard book has been out of print, as the publishers desired, according to their usual practice, to find a successor who would follow a deceased author and bring his work up to date. It has not been easy in this case to pursue this policy, so, in the meantime, the last edition has been reprinted. It goes without saying that everybody, whether engineer, or student, is glad to see this book once more in active circulation.

Cyanide Practice in Mexico. By Ferdinand McCann. Cloth octavo, 200 pages, illustrated. Price 8s. 6d. net. San Francisco: *Mining and Scientific Press*; London: *The Mining Magazine*.

A short time ago the author published a book in Spanish entitled: 'Beneficio de Metales de Plata y Oro por Cyanuración.' This book was well received by all who could read Spanish interested in the cyaniding of silver ores, and the author has done a service

therefore to present it in English also. The bulk of the matter has been published elsewhere, in the *Mining and Scientific Press*, *The Mining Magazine*, the *Engineering and Mining Journal*, the 'Transactions' of the American Institute of Mining Engineers etc., but much of it has been judiciously brought up to date. Additional articles have been written specially for the book by D. L. H. Forbes and Bernard Macdonald. There is a continual demand for information relating to the cyanidation of silver ores, and this book gives the information sought, based on well-established and successful practice.

Electrical Engineering for Mechanical and Mining Engineers. By H. J. S. Heather. Cloth, octavo, 330 pages, illustrated. London: Electrician Printing & Publishing Co. Price 9s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This book consists of a reprint of twenty lectures delivered to the resident mechanical engineers of the mines of the Rand. The course was initiated for the purpose of instructing engineers at the time when electrical power was substituted for steam power on the Rand gold mines. The lectures were so well received, that their re-publication is welcome; mining engineers and mechanical engineers at mines the world over will be glad to have the book. As a rule, technical books of this sort are either ridiculously elementary or far too scientific for the average practical man. Mr. Heather has the useful faculty of meeting his audience, and his lectures were admirably adapted to the requirements of experienced men who desired knowledge of the main outlines of electric-power engineering. The first five chapters of the book give the scientific basis of the application of electric currents, and the methods of measurement. Then follow three chapters on continuous current dynamos and motors, and afterwards the details are given of alternating current generators and motors. Other chapters are devoted to polyphase systems, transformers, and induction motors. Altogether the book is an excellent guide to the modern conditions as regard power at mines.

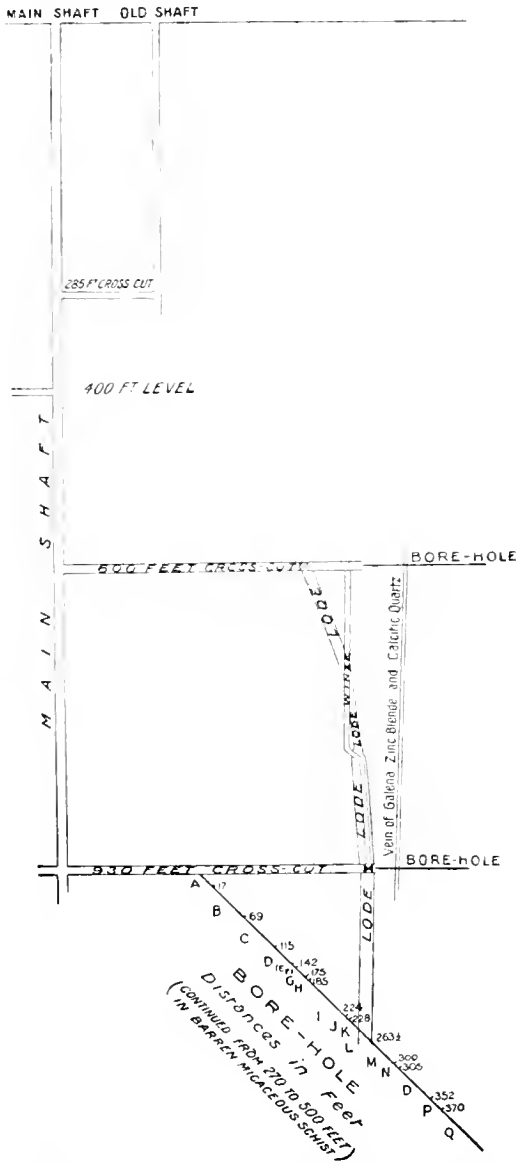
Notes on the Materials of Motor Car Construction.—

By Algernon E. Berriman. Cloth, quarto, 180 pages, illustrated. London: St Martin's Publishing Co. Price 5s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This handsome publication is written by the technical editor of *The Auto*. It is the first effort to deal thoroughly and efficiently with the essentials of an important branch of manufacture. The motor-car is fast becoming more a necessity than a luxury among professional men, therefore Mr. Berriman's writing on the subject will be appreciated. He is a student and scientific observer rather than the exponent of a trade; it is true he knows the practical conditions under which motor cars are made, sold, and used, but this only gives a utilitarian touch to his account of modern metallurgy as applied to automobile engineering. The book was prepared by the assistance of the staff of the Daimler factory, and is to that extent an advertisement of the Daimler car, but this will not annoy the reader if he obtains useful and trustworthy information, as we believe he will. The author says that he has "endeavoured so to write that the lay mind may be introduced to a subject of great interest but much complexity." Well, even a technical man is grateful to anyone who can elucidate complex matters without sacrifice of accuracy or essential truth. We commend the book to those who own cars and to those who hope to own them; that will include most of our readers.

COMPANY REPORTS

Broken Hill South Extended.—This company was registered in London in 1907, and is the second reconstruction of the Australian Broken Hill Consols, which was originally formed in 1888. The property is the



930-ft. level has also given satisfactory results, and the shaft is therefore being sunk to 1130 ft. The accompanying illustration shows the position of the present developments, especially in connection with the bore-hole, which was started at an angle of 45°, 190 ft. back from the face of the 930-ft. cross-cut. The following is a record of the various strata :

- A : 0 to 17 ft. ; Bluish-grey quartz, mineralized with iron and copper pyrite and specks of galena.
- B : 17 to 69 ft. ; Quartz carrying a high percentage of iron pyrite and small patches of blende, slightly garnetiferous.
- C : 69 to 115 ft. ; Indurated quartz carrying pyrrhotite, copper and iron pyrite, and specks of galena ; garnetiferous.
- D : 115 to 142 ft. ; Small bands of hornblendic schist and garnetiferous quartzite.
- E : 142 to 144 ft. ; Garnet and quartz.
- F : 144 to 145 ft. ; Quartz and galena.
- G : 145 to 175 ft. ; Grey quartz with copper pyrite and galena.
- H : 175 to 185 ft. ; Barren quartz and biotite.
- I : 185 to 224 ft. ; Quartz carrying pyrrhotite, copper pyrite and blende.
- J : 224 to 228 ft. ; Quartz richer than I in sulphides.
- K : 228 to 243 ft. ; Barren garnetiferous quartz.
- L : 243 to 263½ ft. ; Lode of high-grade sulphides, 16½ ft. assaying 11·8% lead, 26·3% zinc, and 2½ oz. silver.
- M : 263½ to 300 ft. ; Garnetiferous quartz carrying lower percentage of sulphides.
- N : 300 to 305 ft. ; Intensely hard sandstone.
- O : 305 to 352 ft. ; Garnetiferous quartz carrying pyrite, galena, and blende.
- P : 352 to 370 ft. ; Micaceous schist traversed by small stringers of white quartz carrying galena.
- Q : 370 to 500 ft. ; Barren micaceous schist.

As regards the finance of the company, £55,000 debenture stock was subscribed a year ago by the Murex Magnetic company. A further £20,000 has since been issued. The funds thus obtained are being used for development work, and no dressing plant has been erected. It is possible that ore may be sold to treatment companies instead of being concentrated on the spot. The ore reserve is calculated at 200,000 tons.

Sulphide Corporation.—This company was formed in 1895 by the Exploration Co., and Gibbs, Bright & Co., conjointly, for the purpose of acquiring the Central mine at Broken Hill, the zinc-lead-silver ores of which were to be worked by the Ashcroft electrolytic process. Subsequently this process proved a failure, and on its abandonment, the control passed entirely into the hands of Gibbs, Bright & Co. After an attempt at magnetic separation, the metallurgical problem was solved by the Minerals Separation flotation process. At first, the recovery by this process was low, but the efficiency was gradually improved. The plant as remodelled now treats the whole product of the mine, including the tailings. The ordinary shares received no dividend until 1908. The report for the year ended June 30 last shows that 220,450 tons of ore was raised, and 218,365 tons sent to the lead plant, where 38,156 tons of lead concentrate was obtained, assaying 65·2% lead, 7·4% zinc, and 31·5 oz. silver. The whole of the tailing and overflow was sent to the flotation plant, together with 3764 tons of slime, and 487 tons of tailing obtained when dismantling the old magnetic separators. The average of the 184,460 tons thus treated was 19·9% zinc, 5·5% lead, and 7·8 oz. silver. The result of the flotation treatment was the production of 75,328 tons of concentrate, averaging 43·9% zinc, 10·8% lead, and 17·2 oz. silver ; and the

southernmost of all the mines at Broken Hill. A small dividend was paid in 1891, but none since. As we recorded in our issue of February 1911, a new main shaft has recently been sunk with a view of exploring at depth. The report for the year ended June 30 last, now issued, shows that operations have been centred on the development of the lode at the 930-ft. level, where the ore is of uniformly high grade. A winze connecting the 600-ft. and 930-ft. levels has proved a large block of ore between the two. Diamond-drilling below the

tinal residue averaged 3.1% zinc, 1.8% lead, and 1.4 oz. silver. The concentrate was treated on tables to remove some of the lead, and the final result was 69,826 tons of zinc concentrate, averaging 46.3% zinc, 8.6% lead, and 16.1 oz. silver, and 2821 tons of lead concentrate, averaging 4.1% lead, 13.2% zinc, and 48.7 oz. silver. The total metal in the various products represents 93.1% of the lead, 89.9% of the zinc, and 92.9% of the silver contained in the ore. The lead concentrate was sent to the company's smelter at Cockle Creek, near Newcastle, New South Wales, and the zinc concentrate was shipped to England and the continent. During the year, shortness of labour curtailed operations at the mine. About 8000 tons less was raised as compared with the previous 12 months, and the development was restricted. The ore exposed during the year amounted to 63,600 tons, most of it on the 1200 ft. level. The orebody at this point is promising, so it has been decided to sink the Kintore shaft to 1300 ft. The reserve on June 30 was estimated at 2,499,000 tons, equivalent to 11 years supply. The working account does not give full details of the income from the sale of the concentrates, as the figures include receipts from the sale of lead, gold, and silver, contained in the purchased ores. The net profit was £311,227, out of which £30,000 has been placed to reserve, and £278,750 distributed as dividend, being at the rate of 30 per cent. on both the preference and ordinary shares.

Kalgurli Gold.—This company has been working a property at the northern end of the 'Golden Mile' at Kalgurli, West Australia, since 1897. The first dividend was paid in 1902. The most prosperous years were from 1906 to 1909. As recorded in our issue of January a year ago, the grade of ore is now decreasing, owing to the absence of rich streaks of telluride. The report for the year ended August 31 last shows that 123,800 tons of ore was raised and treated, yielding gold worth £251,630, or 40s. 7d. per ton. The yield the previous year was 47s. 2d., and 52s. 1d. the year before that. For the last 6 years the amount of ore treated has been practically the same each year. The extraction was 93.3%. The profit was £95,768, and the dividend absorbed £96,000, being at the rate of 80%. As regards ore reserve, R. S. Black, the manager, follows his usual custom of refraining to give exact estimates of ore that is so erratic, but he quotes 250,000 tons as a safe figure, and mentions that ore is being stoped from 18 levels, none of which are as yet depleted. The mining and treatment cost during the past year was 20s. 6d. per ton, as compared with 19s. 10½d. the previous year.

North Kalgurli.—This company was originally formed in 1875 and was reconstructed in 1901. The property adjoins the Kalgurli mentioned in the previous paragraph, but it has not shared its success, and is not under the same control. No dividends have been paid and the mine is let on lease. The plant contains 20 stamps. The report for the year ended August 31 shows that 10,003 tons of ore was raised by the tributaries, yielding 6440 oz. gold, worth £27,354. The sum of £23,240 was paid to the tributaries, and the total expenses were £25,481. It has been decided to write down the capital from 10s. per share to 2s., the number of shares issued is 301,411.

Burbank's Main Lode.—This company was originally formed in 1896 to acquire a gold mining property at Burbank, 4½ miles south of Coolgardie, West Australia. There have been several reconstructions, and dividends were first paid in 1906. The mill contains 10 stamps and cyanide plant. The capital has been increased during the past year by the issue of 11,475

shares of 4s. each, bringing the total capital to £37,562. The report for the year ended June 30 shows that 20,336 tons of ore was raised and treated, yielding gold worth £45,354. The working cost was £25,978, the London expenses £1229, allowance for depreciation of plant £2275, and charge for development £7880, leaving a balance of £8144, out of which £4695 has been distributed as dividend, being at the rate of 12½%. William Nicholas, jr., the consulting engineer, reports that the ore reserve on June 30 was 31,000 tons, as compared with 27,000 tons a year ago.

Ida H. Gold.—This company was formed by the North-Wadlington group in 1900 to acquire a mine in the Mount Margaret district of West Australia. From 1902 to 1906, dividends aggregating 142½ per cent. were distributed, on a capital of £54,000. Since then no divisible profit has been made. In March 1911 the management was changed, R. A. Varden, local partner of Hooper, Speak & Co., assuming the direction of affairs. During the year ended June 30 last, the development work did not reveal any ore of value, but at the meeting of shareholders held on December 19, much better news as to future prospects was announced. During the year under review, 13,007 tons of ore was sent to the 10-stamp mill, where 10,259 oz. of gold was recovered by amalgamation and 1198 oz. in concentrate. There is a cyanide plant at the mine, but as the gold in the mill tailing is almost entirely contained in the pyrite, it is not now in use. The above figures for the production of gold by amalgamation are apparently in bullion ounces, for the accounts state that the gross value of the gold produced was £36,173. The mining and milling cost was £21,638, and that of development £7614; London expenses absorbed £2381, and £1686 was allowed for depreciation of plant, etc. The balance of profit was £1888. During the year, an interest has been acquired, on reasonable terms, to the extent of 48,226 shares of £1 each out of 100,000, in the Rukuba (Nigeria) Tin Mining Co., but as the tin deposit is not yet proved, the directors do not place a definite value on this holding.

Whim Well Copper.—This company was formed in 1906 to acquire a copper property in the northern part of West Australia, in the West Pilbara district, and not far from the port of Roeburne. H. R. Sleeman is manager. As recorded in previous notices, the ore occurs in a flat lode, and part of the oxidized ore at the surface is of sufficiently high grade to stand the cost of shipment abroad. Diamond-drilling has proved the existence of sulphides below. The most important item in the report for the year ended March 31 last is the news relating to the development of the sulphide ores. They are stated to be of large extent and to be of similar value to the ores above. During the year, 16,414 tons averaging 10% was mined, together with 435 tons averaging 30% bagged direct from the faces, and 455 tons averaging 4% sent to the dumps. The total shipments by steamer and sailing vessel were 12,230 tons averaging 13½% copper. On March 31, the broken ore in stock consisted of 499 tons averaging 12%, 50,000 tons averaging 5%, and 2930 tons averaging 4%. The reserve ready for stoping was 100,000 tons, and the probable ore above water-level was 1,000,000 tons. As already recorded, a Murex magnetic concentrator with a capacity of 200 tons per day is being provided, and it should be in operation by the time these lines appear in print. The future policy relating to smelting will depend on the success of this plant. The accounts for the year show an income of £65,569 from the sale of ore. The cost of mining was £26,349, and of freight and realization £12,095. After London and general expenses and debenture interest

had been paid, the balance of profit was £23,682. A dividend of £10,000, being at the rate of 5%, has been paid; £2328 has been placed to reserve for income tax; and £6500 has been written off for cost of plant and development.

Great Cobar.—This company was formed in London in 1906 to acquire the Cobar copper mine in New South Wales. The purchase price was £800,000 in cash and £206,000 in shares. The reports on which the business was effected was made by J. D. Kendall, C. M. Rolker, and W. J. Barnett. The Lithgow refining works, near Sydney, and the Chesney copper mine were bought at the same time, and two years ago the Cobar gold mine was acquired, the gold-bearing silicious ores of the latter making a suitable flux for the pyrite ore of the Great Cobar. Many difficulties have been encountered in carrying out the expectations of the prospectus. Errors were made in the design of the new furnaces; the ore did not come up to expectations as to content; and a succession of labour troubles have intervened. H. C. Bellinger, late of Montana, is now manager. The report for the year ended June 30 shows that 271,827 tons of Great Cobar ore was raised and sent to the smelter; the production from the Cobar Gold mine was 45,778; while 29,712 tons was raised from the Chesney mine. All the ore from the first two was sent to the smelter direct; 20,254 tons was sent direct from the Chesney, together with 1478 tons of concentrate obtained from the remaining 9730 tons. The total metals recovered was 6736 tons of copper, 37,696 oz. gold, and 178,938 oz. silver. The average assays of the various ores are not given; but the general tenor can be presumed from the figures for the reserves. At the Great Cobar, the reserve was estimated on June 30 at 1,813,087 tons averaging 2.6 per cent. copper; at the Cobar Gold 302,174 tons averaging 1.7 per cent. copper and 9 dwt. gold; at the Chesney 623,286 tons averaging 2.6 per cent. copper. Developments during the year at Cobar Gold and Chesney have been entirely satisfactory. At the Great Cobar, the 12th level showed a dislocation of the lodes, and diamond-drilling was undertaken with the object of finding the displaced northern orebody. Subsequent work on the 13th level has given much better results, for a cross-cut north has intersected a body of ore averaging 3½ per cent. copper; the cross-cut has passed through 40 ft. and is still in ore. It is believed that this is the lost northern orebody. At the Chesney mine, the erection of the concentrator was greatly delayed, and it only started work in April last. A Minerals Separation plant is to re-treat the tailing. As regards finances, the income from the production of metals was £635,252, the cost of mining and smelting was £457,222, and the London expenses £9413. The allowance for depreciation was £47,686, £43,488 was paid as interest on £724,800 debentures, and £43,161 has been written off underwriting commission. The balance of profit was £34,356, which was carried forward. It will thus be seen that no dividend has as yet been distributed on the £932,710 ordinary shares.

Minerals Separation.—As far as the accounts are concerned, the report of this company covers the year ended December 31, 1911, but otherwise the information in it, and also that given by the chairman, John Ballot, at the meeting of shareholders, is right up to date. As regards the accounts the income was £26,531 from royalties and profits from the treatment of tailing; the technical management cost £15,739 and the London administration £5810; the balance of profit was £2702. As already recorded in our pages, the Australian patent rights were amalgamated with those of the De Bavay company in April last, and a new com-

pany called the 'Minerals Separation and De Bavay's Processes Australia Proprietary Co.' formed to collect and distribute the royalties. The operations of this new company have been eminently satisfactory, and an interim quarterly dividend has already been paid at the rate of 10 per cent. per annum. Three new installations of importance are mentioned in the report; one is at a Swedish mine and has a capacity of 150 tons per day; a second is at the Chesnev copper mine belonging to the Great Cobar company in New South Wales, where 150,000 to 200,000 tons per year are to be treated; and the third is at the Braden copper mine in Chile, having a capacity of 3000 tons per day. During 1913 the total tonnage throughout the world treated by Minerals Separation plant is expected to be somewhere from three to four million tons. The company's own plant at Broken Hill is now idle, as the whole of the purchased tailing is exhausted; the plants working the process at the Sulphide Corporation and the Zinc Corporation in the same district are giving excellent results. The action against James M. Hyde for infringement is expected to be tried at the Federal Court, at Butte, Montana, in the course of a month or two, and the final hearing of the *Elmore versus Sulphide Corporation* before the Judicial Committee of the Privy Council will also take place shortly.

Viloro.—This company was formed in 1904 to acquire 200 acres of gold gravel in the Oroville district, California. Walter McDermott is chairman, and T. H. Leggett is consulting engineer. The issued capital is £65,979. Dividends have been paid since the start, and up to October 31 last have totalled 73½%. The report for the year ended October 31 shows that 710,257 cubic yards, over 13½ acres, was dredged, yielding gold worth \$89,277, at a cost of \$50,150, leaving a profit of \$39,127. The yield per cubic yard was 12.57 cents, and the cost 7.06 cents. The amount treated was 164,588 cubic yards less than during the previous year, the fall being due to the increase in the proportion of stiff clayey ground. Of the 200 acres, 130 have been worked, and of the remainder some parts are too lean to be profitable. Mr. Leggett estimates that the deposit will be exhausted in from 4 to 4½ years. W. H. James, the manager, reports that the overburden, varying from 8 to 20 ft. in depth, has proved troublesome to remove, and some of it has had to be broken by explosives. After the payment of administration expenses, a profit of £7188 was made, out of which £6597 has been paid as dividend, being at the rate of 10 per cent.

New Chuquitambo Gold Mines.—This company was formed in 1901 for the purpose of acquiring gold mines at La Quina, in the district of Cerro de Pasco, Peru. In 1907 reconstruction was necessary, and the nominal capital was at the same time reduced in the proportion of 16 to 1. The issued capital now stands at £44,300. A 40-stamp mill started operations in 1907. Dividends have been paid since 1908, at the rates of 6, 11, 5, and 5% respectively. The directors' report now issued covers the year ended June 30 last; that by Merricks, Crane & Co., the consulting engineers, was issued in October. From these it appears that the deposits are held to be the filling of old river beds, otherwise fossil placers. The rock is soft and can be mined by adit, so that the cost is small, averaging 6s. per ton. The exploration work done during the last two years has revealed the presence of large bodies of ore varying in content from 2½ to 5 dwt. per ton. The recovery is low, being about 66%, and the cyanide plant does not give the expected result on the tailing. Further metallurgical investigations are being made. An additional 80 acres of ground has been acquired, bringing

the total area to 140 acres. During the year under review 25,439 tons of ore was raised and treated, yielding gold worth £15,932, the expenses were £11,877, £3,000 was written off the cost of the cyanide plant, £225 was distributed as dividend. It is expected that, in future, dividends to this amount will be distributed quarterly.

St. John del Rey.—This company was formed in London as long ago as 1830, for the purpose of acquiring the Morro Velho gold mine, in the state of Minas Geraes, Brazil. In our issue of July last we recorded that the company had had the most successful year of its existence as regards the output of gold, and that the projected shaft-sinking promised to maintain the record for deep working in gold mines. The half-yearly interim report now issued, covering the six months ended August 31 last, shows that much inconvenience has been caused by scarcity of labour. There had been a movement recently among workmen in Minas Geraes for an eight-hour day with the same wages, but as the St. John del Rey could not stand the demand, many of the best men left for railway and other work. To counteract this loss, English rock-drill men have been imported, and a plan has been revived for bringing labourers from Japan. During the half-year, 93,338 tons of ore was raised, and after the rejection of waste, 91,958 tons was sent to the 130 stamps. The yield of gold by amalgamation and cyanide was worth £214,479, or 46s. 8d. per ton. Taxes and bullion-transport charges absorbed £9375; the working cost was £128,600, or 27s. 11d. per ton; £2940 was charged to development, London expenses £2866. Debenture interest absorbed £2252, dividend on preference shares £5292, and dividend on ordinary shares £21,680, being at the rate of 9d. per £1 share. The machinery for G shaft has been erected and the shaft sunk 438 ft. At 288 ft. it was connected with a drift from horizon 17. The new winze (No. 23) will be sunk below horizon 17, to prove the lode at a further depth of 300 ft., at which point a new horizon (No. 18) will be developed. In driving beyond the western end of the lode at horizon 15, for the purpose of making a chamber to be used as a compressed air reservoir, a branch vein was proved. The development so far done, along 89 ft., shows that this vein is 6 ft. wide, but that its content is rather lower than that of the main lode; however, it is worth mining.

Pahang Consolidated.—This company was formed in 1906 for the purpose of consolidating the Pahang Corporation with other companies operating adjoining lode and gravel tin properties, in the state of Pahang, on the eastern side of the Malay peninsula. Four years ago, £125,000 of additional capital was subscribed for the purpose of developing the various properties on a more adequate scale. Profits were made in the year ended July 31, 1911, but were applied towards extinguishing an adverse balance. The report for the year ended July 31 last shows that the improvement has continued. The 50-stamp mill treated 102,797 long tons of ore, for a yield of 1125 tons of tin concentrate, as compared with 78,448 tons and 973 tons the year before. The alluvial deposits are worked by tributaries, and the production was 115 tons as compared with 54. The income from the sale of concentrate was £145,755, and the profit, after payment of administration expenses, £45,341. Out of this, £4390 was paid as interest on debentures, £5000 was written off expenses of raising capital, £5000 allowed for depreciation of plant, and £10,000 allowed for development and exploration. The year commenced with an adverse balance of £2521, and ended with a divisible profit of £18,879. Out of this, the whole of the ar-

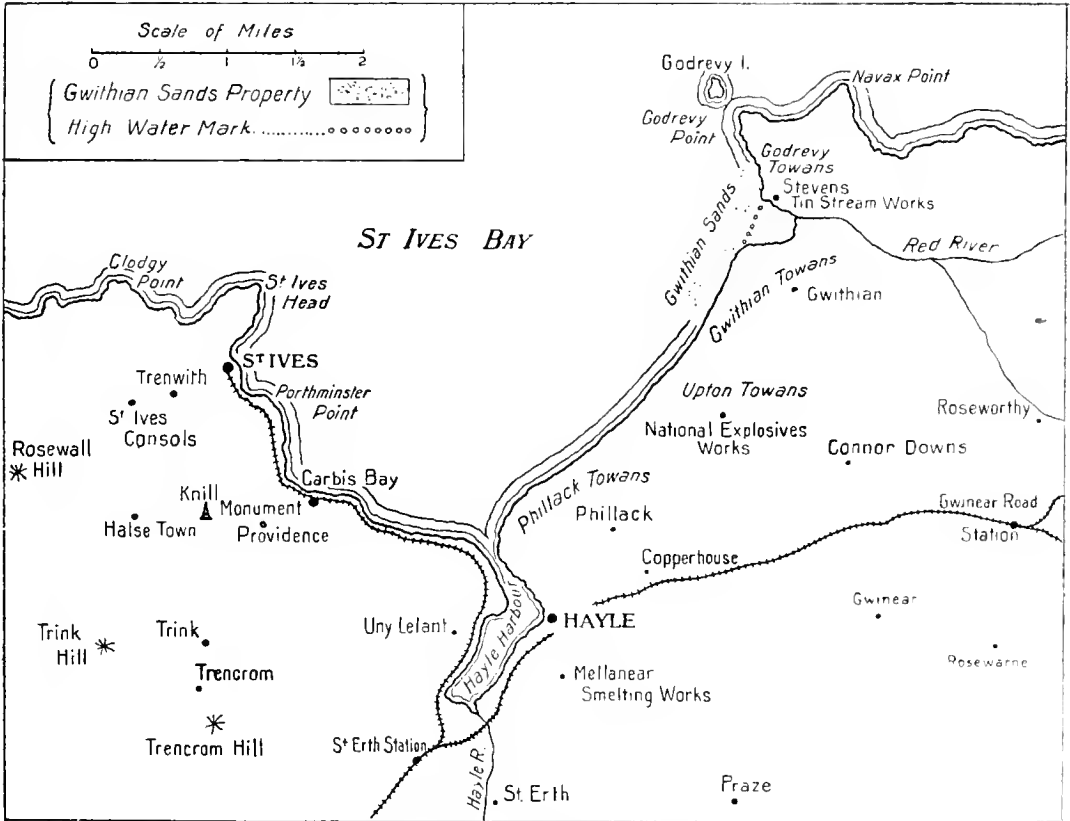
rears in the preference dividend covering a period of 4 years and 1 month has been paid, absorbing £15,577. J. T. Marriner, the manager, reports that the crushing and concentration plant had been greatly improved, so that its capacity has been increased and the cost of operation decreased. No less than 28,869 ft. of development work has been done, distributed over eight mines, along 5 miles. The ore sent to the mill came from 7 of these properties, the largest amounts being provided by Willink's, Semehang, Jeram Batang, Teague's, and Pollock's. The most important discovery was at Willink's, where the junction of two or more lodes has provided a large amount of rich ore, at the 500 ft. level the lode has been proved, so far, for 247 ft. averaging 9% cassiterite over a stoping width of 5 ft. As regards reserve, this is not easy to calculate, for so much of it consists of ore left by former owners; while the stamps are not far ahead on the newly discovered ore.

Cornish Tin Sands.—This company has been formed by the Rayfield (Cornwall) Tin Syndicate, of which Oliver Wethered is the leading spirit, for the purpose of acquiring the Gwithian tin sands at the mouth of the Red river, in St. Ives bay. The capital is £120,000. The property was examined and fully tested by G. K. Nicolaus for Percy Tarbutt & Co., and his report was issued early in December. This is accompanied by a large scale map showing the position and results of the various borings. Incidentally we may remark that in reproducing the original drawing, the draughtsman forgot to alter the scale. We give herewith an outline map showing the part of the beach sampled. It will be seen that the sands extend inland as flats for some distance above high-water mark. The Red river flows along the northern shore of this dry bay. Here is situated David Stevens' works, where for many years the sand of the flats has been treated on a small scale and profitably. Mr. Nicolaus describes the method in use at these works. The sand is obtained by stripping and screening the richest spots along the head of the beach, which have previously been tested by vanning. This is carted to the works, approximately to the amount of 15 tons per day. The content varies from 20 to 48 lb. of metal per ton. The sand is ground in pans and buddled, the concentrate produced assaying 30 to 40% metal. This is roasted and concentrated again, giving a final product assaying 65% metal. It is estimated that 60% of the content of the sand is recovered. The concentrate is of higher tin content and lower in iron and wolfram than that produced in the tin-stream works, owing to the oxidizing action to which the sand is exposed on the beach. Probably the roasting is required chiefly for changing the colloidal form of the tin slime, rather than for the removal of sulphur. The Red river in former days varied its course over the flats, and the rough tides and winds have shifted the sand, the two influences together explaining the distribution of the cassiterite over large areas. Sampling over the area marked in the map disclosed 1,259,444 cubic yards wet, equivalent to 1,419,107 long tons dry. The average metallic content was 7.11 lb. per ton. The average depth of deposit was 52 inches. Along the southern edge of the western flats 210,382 tons showed 10.71 lb. per ton, and the average depth of the deposit was 16 ft. Mr. Nicolaus has picked out the most promising portions, and bases his estimates on 722,715 tons, averaging 9.35 lb. per ton. He is of opinion that Mr. Stevens' method of treatment will have to be pursued, that is to say, the sand removed to a concentrating plant, not treated on a floating dredge or by alluvial mining methods. The cassiterite is too fine for the latter method of treatment,

and the sand requires re-grinding. Naturally, modern re-grinding machines and slime-concentrators will be considered when the new plant is devised. The cost of treatment is estimated at 4s. per ton. We ought to record the fact that the 'G. R.' Nicolaus who writes this report is the 'R. C.' Nicolaus of earlier days. The change of premen was made six months or so ago. In our issue of November last we gave him his earlier initials.

St. Ives Consolidated.—This company was formed by the Schiff group in June 1908 to acquire from the parent company, the National Minerals Corporation,

much work has been done in re-opening and repairing the old shafts and levels. Tin ore has been found in the Trenwith mine and is to be developed. The working account at the Giew mine for the 18 months shows sales of tin concentrate, 199 tons, bringing £21,160, and expenses, £19,797. The balance sheet shows additional expenditure of £16,563, some of which went as commission in placing debentures and debenture interest, and the rest in mining and administration. Other receipts included £6459 as dividend on the shareholding in the radium company. It was found necessary to have further working capital, and for this pur-



PART OF CORNWALL, showing position of GWITHIAN BEACH.

a number of leases of old tin and uranium mines in the neighbourhood of St. Ives, Cornwall. The Trenwith is being worked for pitchblende, and the radium is extracted by a subsidiary company, the British Radium Corporation. The chief tin properties are the Consols and the Giew. The report now issued covers the 18 months ended June 30. This shows that the Giew mine has been unwatered to the bottom of Frank's shaft, 142 fathoms below adit, and that it is intended to continue the unwatering to the bottom of Robinson's shaft, 212 fm. below adit. The 20-stamp mill was working on dump ore and mine ore until the end of the period under review; since then, supplies have been drawn from the mine alone. On September 15 the reserve was estimated at 25,000 tons, averaging 24.5 lb. per ton. It is proposed to add 10 more stamps and a tube-mill. The Consols mine has been unwatered to the 137-fm. level, or within 40 fm. of the bottom of the old work-

pose £60,000 debentures were issued; another £60,000 are now being offered for subscription. The share capital stands at £220,000.

Cape Copper.—This company was formed in 1863 to work the Ookiep copper mine, situated in Namaqualand, South Africa. John Taylor & Sons are the managers. Some high-grade ore is shipped, together with matte from the low-grade ores, to the company's smelting works at Britonterry, South Wales. For some years the supply of high-grade ore has been restricted, and search has been made for other properties. The report for the year ended April 30 at the mine and August 31 in London, shows that 16,986 tons of ore averaging 12.4% copper was extracted from the Ookiep mine, as compared with 15,978 tons averaging 12% the year before. Most of the ore came from the stopes and pillars in the neighbourhood of the 68-fm. level. Diamond-drilling, started from the bottom of the mine,

has revealed nothing of value, but similar work from the surface 700 ft. east of the New shaft, disclosed a vein 5 ft. wide at a depth of 421 ft., estimated to contain 6% copper. Subsequently another bore hole 500 ft. east of the New shaft cut similar ore at 307 ft. Holes are now being driven horizontally from the 68-ft. level to test this orebody further. The ore reserve is calculated at 6000 tons averaging 20% copper, as compared with 8000 tons a year ago. At the NababEEP South mine, 55,970 tons of ore was raised, averaging 5.27% ligates not much different from those a year ago, and at NababEEP South 5035 tons averaging 5.71% was raised. At the NababEEP North, the ore reserve was 130,000 tons averaging 5%, as compared with 172,200 tons the year before. Extensive diamond-drilling has been done, with the result that a large orebody was discovered between the 74-ft. and 100 ft. levels. This ground is now being developed and tested. Exploration is being continued at the Narrap mine, but the Springbok and Koperberg have been abandoned. The property under option in India continues to do well; 4698 ft. of development was done during the year, together with 1632 ft. of diamond-drilling. The reserve is estimated at 121,418 tons of 5.11% ore, and 68,194 tons of 2.6% ore. A concentration plant has been ordered. A sulphur-copper property in Newfoundland is also being tried, containing ore similar to that at Tilt Cove. Smelting has been continued at both Ookiep and NababEEP, but it has been decided in future to do all the work at the latter place, and a new furnace is being built there. The works at Britonterry have been greatly improved, and an electrolytic refinery provided. The accounts show a profit, after all taxes and allowances for depreciation have been deducted, of £53,137, of which £7536 was income from the company's interest in the Tilt Cove Copper Co. Out of this, £7875 has been paid on the preference shares, and £42,500 on the ordinary shares, both being at the rate of 8½%, as compared with 6½% the year before.

Champion Reef.—This company was formed by John Taylor & Sons in 1889, to acquire gold-mining leases in the Kolar district of India, immediately adjoining the Mysore gold mine. As we have recorded on previous occasions, the mine has been exceedingly profitable, and up to September 30 last, the total yield was worth £10,102,300. The prosperity steadily increased until 1905, during which year the dividends totalled £416,000, or 160% on the nominal capital. Subsequently the ore became leaner, and the profits decreased, until only 20% was paid in 1908 and 1909. Since then the content of the ore mined has slightly increased, and notwithstanding the facts that a reserve fund is being established, and that all expenses are now charged against revenue instead of new shares being issued for capital expenditure, the profits have gradually increased. One important feature is the substantial decrease in costs, due largely to the introduction of electric power from the Cauvery Falls, and another is the increasing amount of gold won from the tailing by means of the cyanide process. The installation of the Butters filter, which was put into operation in September, will further improve the extraction. The report now issued covers the year ended September 30. During this period, 220,610 tons of ore was sent to the mill, an increase of 15,441 tons as compared with the previous 12 months, and 289,733 tons of tailing and slime was treated in the cyanide plant. The yield by amalgamation was 93,168 oz., and by cyanide 25,219 oz., making a total of 118,386 oz. worth £501,468, an increase of £33,150 over the previous year. The working cost was £288,587, or 26s. 1d. per

ton milled, a decrease of 1s. 1d. as compared with the previous year. In addition to the working cost, £7340 has been paid as income tax, £1560 paid to the directors as percentage on dividends, £34,280 spent on shaft-sinking, and £15,000 placed to the reserve fund, which now stands at £30,000. The shareholders receive £130,000, or 50% on the nominal capital, as compared with 43½% the year before. In estimating the return on capital invested, it must be remembered that in 1895, 1901, and 1903, new shares represented in the aggregate by £55,000 in the nominal capital were sold for £467,000. The total dividends have been £3,888,966. During the year under review, 19,510 ft. of development work has been done, including 1777 ft. of shaft-sinking. The ore reserve has been increased by 35,451 tons, and now stands at 400,747 tons. The sinking of the new vertical circular shaft has been continued, and it is now down to 3510 ft. The equipment is in hand and most of the hoisting plant is on the way to the mine. The steel head-gear has been erected. As regards developments, the ore-shoot on the 36th level, between the Garland and Glen shafts, is most promising, having been proved for 800 ft., and for 280 ft. the lode averages 9 ft. wide. South of the Glen shaft, large reserves of ore have been proved on the 37th, 38th, and 39th levels. In Carmichael's section, the northward drifts on the 41st, 42nd, and 43rd levels are all in good ore.

Ashanti Goldfields Corporation.—This company was formed in 1897 to acquire properties in the hinterland of the Gold Coast, West Africa, from the Cote d'Or company. Frederick Gordon, of hotel fame, was the moving spirit, and he and his friends found most of the working capital in the early days, the consideration being 10% of the annual profits, since reduced to 3%. The capital has been increased from time to time, by the issue of shares to the public at high premiums. For instance in 1900, an issue of 10,000 shares nominally £1 was sold for £10, and in the following year 20,000 £1 shares were sold at £25 each. The £1 shares were split into five shares of 4s. each in 1901. The present capital consists of 1,071,466 shares of 4s. each, equal to £214,293. From 1909 onward the profits have been substantial. We have during the last three years recorded the recent improvements in the metallurgical treatment, and the discovery of rich ore in the Obuasi shoot. W. R. Feldtmann is consulting engineer. The report for the year ended June 30 last shows that 153,554 tons of ore was raised and treated, yielding 111,266 oz. gold worth £474,365, being 14.49 dwt. or 61s. 9½d. per ton. In addition, 16,860 tons of old tailing was treated, yielding 3328 oz., worth £14,232. The total income was worth £493,461. The tonnage treated showed an increase of 29,000 over the previous year, and the yield an increase of £62,682. The working expenses were £279,036, as against £275,866; the cost per ton was 35s. 5½d. as against 43s. 1d., a substantial reduction of 7s. 7½d. The distributable profit was £214,425, as against £154,911, and the dividend was £187,001 or 87½%, as compared with 75% the year before. The ore reserve on June 30 was 392,840 tons, averaging 17.7 dwt. per ton, containing gold worth £1,481,000, and estimated to yield a profit of £552,300. A year ago the reserve was 508,200 tons. One reason for the smaller figure is that a recalculation of part of the Obuasi shoot, based on additional data, revealed a smaller tonnage and content than was expected.

Bibiani.—This company owns a gold mine in West Africa, 100 miles north of Prestea, and lacking railway communication. Since its formation in 1899, calamities of one sort and another have been plentiful.

There have been two reconstructions, and a receiver, appointed by the court for the protection of debenture holders, is now in charge pending the completion of some scheme for raising further funds. The want of success is not due to the absence of an orebody, for the reserve on December 31, 1911, was 225,705 tons positive, averaging 35s. per ton, and 87,534 tons probable, averaging 37s. per ton. The report now issued shows that the trouble has arisen from the failure of power plant due to its poor quality, and to the intractability of the slime. The final disaster was a flood which filled the mine to No. 1 level in April last, and it is only recently that the water has been removed. During the year 1911, covered by the report, 80,154 tons of ore was raised yielding gold worth £94,897, or 23s. 8d. per ton. The small recovery is due to the fact that the slime-tailing at present untreatable is estimated to contain 20s. per ton. The working cost was £77,121, London expenses £2472, and debenture interest £4850; allowance for depreciation of plant was £14,749, and £9171 was written off development account. The adverse balance was £13,731. The issued capital is £200,714, and there are £97,010 debentures. Hooper, Speak & Co. are the consulting engineers.

Broomassie Mines.—This company was formed in 1901 to acquire a gold-mining property at Broomassie, on the Ancobra river, about 20 miles northwest of Tarkwa, West Africa, together with dredging rights on the Ancobra and Mansi rivers. Two reconstructions have been necessary, the last in 1909, when Bewick, Moreing & Co., were appointed consulting engineers. Milling was recommenced in March 1911. The report for the year ended September 30, shows that success has at last been attained. During the year, 34,081 tons of ore was milled, yielding by amalgamation gold worth £110,412, together with 480 tons of concentrate assaying £18. 13s. 2d. in gold per ton. The assay-value of the tailing was 3'18 dwt. per ton, but its treatment by cyanide is unremunerative and has been suspended. A roasting furnace and filter-press plant are to be erected for the local treatment of the concentrate. Development has given satisfactory results during the year, but as the ore exposed is a long distance from the main shaft, the expense of mining is not low. On December 1, the ore reserve was reported at 35,200 tons, averaging 21'3 dwt. per ton, together with 8800 tons exposed below the 1170-ft. level valued at 30'6 dwt. per ton. There is also three times as much ore that cannot be included in the reserve while costs are so high. The accounts for the year show an income of £119,189, current expenses £89,722, and various administration expenses written off £12,495, leaving a profit of £16,972. Since the close of the financial year, the conditions have been so favourable that the directors have decided to declare a dividend at the rate of 10 per cent on the issued capital, £200,175. The present cost per ton is 32s. 5d. for mining and milling, 10s. 4d. for development redemption, 5s. 11d. for depreciation, 2s. 2d. for London Office expenditure, and 1s. 8d. for debenture interest, making a total of 52s. 8d. per ton.

Vogelstruis Estate & Gold Mine.—As reported in this column a year ago, the mine belonging to this company, 7 miles west of Johannesburg on the outcrop, is nearing its end, and all that is expected is an interest on the debentures. The company was formed in 1893 to acquire the property from the debenture holders of the Vogelstruis Gold Mining Co. A mill containing 80 stamps started in 1896, but did not run for long owing to limited supplies of ore. Another start was made in 1903, and small dividends were distribut-

ed in 1907-8-9. The control is in London, and the board includes such well known names as Struben and Molteno. H. Ross Skinner is consulting engineer, and R. L. Alston is manager. The report for the year ended June 30 last shows that 125,128 tons of ore was milled yielding gold worth £148,496, both figures being slightly greater than those of last year. Development has about kept pace with extraction, and the reserve remains at practically a year's supply. The upper levels are being reopened with a view to the removal of some of the ore left behind, and sinking has been commenced at the eastern end of the property in some old surface-workings. The profit at the mine for the year was £8593, out of which £5646 was paid as debenture interest, and £1688 for administration. It was necessary also to write off £8317 for depreciation. The net result was an adverse balance of £7236, which, added to the debit balance brought forward from the previous year, made a total deficit of £24,344.

H. E. Proprietary.—This company was originally formed as the H. E. Syndicate in 1899, the letters 'H.E.' standing for 'Hamilton-Ehrlich.' It was reconstructed on its present basis in 1901. The property acquired consists of gold and copper properties in the Murchison range, Transvaal. Particulars of this district were given by Alexander O. Brown in our issue of October last. The inaccessibility of the district has delayed operations, and though the railway connecting with Delagoa Bay is nearly complete, it has not been deemed advisable as yet to resume active development. The company also owns substantial interests in the New Lisbon-Berlyn Co., and in the Murchison Free State Gold Mining Co., neither of which have as yet distributed dividends. Prospecting at the Magato copper concession, under the direction of J. M. Calderwood, has been commenced, and the results of work so far done are promising.

Knights Deep.—This company belongs to the Consolidated Gold Fields group, and owns property on the dip of the Glencairn and Knights, two mines under Barnato control, and situated in the middle east Rand. At the southwest corner it is contiguous to the Simmer East, one of the unsuccessful deep-levels under the Gold Fields direction. For some time, Knights Deep has leased 70 of the Simmer East stamps, oringing its own equipment to 270 stamps. Two months ago, Simmer East failed to pay its debenture interest, and its property was absorbed by Knights Deep. Both mines contain ore of low grade, but Knights Deep has been able to work at less cost than Simmer East. It is therefore expected that, under the new arrangement, the Simmer East deposits may be made profitable. The report for the year ended July 31 last, shows that 751,058 tons was mined, and after the removal of 3% waste, 727,700 tons was sent to the mills. The yield by amalgamation and cyaniding was 151,115 oz. worth £634,127, or 17s. 5d. per ton. The working cost was £418,519, or 11s. 6d. per ton, leaving a profit of £216,465 or 5s. 11d. per ton. After the payment of debenture interest and tax, and redeeming £23,500 of debentures, there remained a disposable balance of £177,475, out of which £176,969 was distributed as dividend, being at the rate of 27½%. As compared with the previous year, the tonnage crushed showed an increase of 32,030 tons, and the working cost was reduced by 4d. per ton; on the other hand the content of the ore was 2s. 7d. lower, and the dividend compares with one of 35% last year. The ore reserve at July 31 was 1,477,414 tons, averaging 4'7 dwt., and there were 46,000 tons partly developed of an indicated content of 4'3 dwt. The rest of the mine has been developed, but the value of the ore is not yet ascertained.

Ferreira Deep.—The mine belonging to this company has suffered more from movements of the hanging wall than any other mine on the Rand. Since the serious crush occurred two years ago, not only has it been necessary to resort to filling some of the stopes with waste, but also to vary the method of mining. A caving system is now employed. The ore as broken is picked in the stopes until the boundaries are reached, and on subsequent withdrawal of the ore the hanging wall is allowed to fall. During the past year the property of the Ferreira outcrop company was purchased for 70,000 shares. By this arrangement it has been possible to mine the ore left at the boundary in the 1st and 2nd levels of the Deep mine. Developments in the Deep have been actively pushed, so that it is now possible to send some ore to the mill belonging to the Ferreira. The report now issued covers the year ended September 30. This shows that 663,081 tons of ore was raised, and after the removal of 15% waste, 558,920 tons, averaging 41s 6d per ton, was sent to the mill, where 220 stamps and 6 tube-mills were regularly employed. The yield by amalgamation was 182,424 oz., and by cyanide 83,746 oz., a total of 266,170 oz., worth £1,116,979, or 39s 11d per ton. The working cost was £595,418 or 21s 3d per ton, leaving a profit of £521,560 or 18s 8d per ton. A further profit of £10,428 was made by the re-treatment of 22,000 tons of accumulations. Out of the profit, £47,409 was paid as tax, and £402,500 distributed as dividend, being at the rate of 4½ per cent.

Van Ryn Gold Mines Estate.—This company was formed in 1892 to acquire property on the outcrop in the far east Rand. A dividend was paid in 1895, but it was not until 1904 that steady prosperity was attained. The deposit is of lower grade at the surface than in the central Rand, and the mine is in fact the pioneer in the successful treatment of low-grade ore in the far east Rand. The control is with the Albus, and E. G. St. John is manager. The report for the year ended June 30 shows that the ore reserve has been substantially increased, and that the treatment plant has been overhauled and extended. The plant now contains 160 stamps and 6 tube-mills. The tonnage crushed was 460,740, an increase of 64,300 tons as compared with the previous year. The yield of gold was 150,850 oz., worth £639,395, an increase of 17,118 oz. or £72,630. The working cost was £363,161, and the working profit £276,234, an increase of £13,893. The figures per ton were respectively 27s 9d, 15s 9d, and 12s. The cost per ton was 5d higher, due chiefly to the increase in wages. Out of the working profit, £29,431 was written off mine-equipment, and £24,206 was paid as tax. The shareholders received £225,000, or 45% the same as the year before. No less than 20,007 feet of development work has been done, or nearly double that of the previous year, and the reserve has been increased by 408,534 tons. The reserve now stands at 2,064,444 tons, averaging 6 ½ dwt. per ton, and 82,365 tons of partly developed ore averaging 5 2½ dwt. There are also blocks totalling 663,323 tons containing less than 4 dwt., and it is intended to further investigate them with a view of finding profitable portions. The Van Ryn is worked in two sections, and a third called No. 3 is now being developed; the results so far obtained are highly promising. No new shaft is being sunk, but connection is made by crosscuts to No. 2 shaft.

Luipaard's Vlei Estate & Gold.—This company was formed in 1888 by the Consolidated Gold Fields of South Africa, to work property in the far west Rand. In 1902 the mine of the Windsor company was acquired. Until the past year the management has been

in the hands of the Consolidated Gold Fields, but recently this arrangement has been terminated, and the company is housed with the Ehrlich group. C. H. Siner was appointed manager six months ago. Owing to the irregularity and low grade of the orebodies, their profitable exploitation has been a matter of difficulty. The company has a modern plant containing 60 stamps and 3 tube-mills. During the year ended June 30 last, 262,369 tons was mined, of this, 21,033 tons was rejected below, and 43,579 tons above ground. The amount sent to the mill was 199,141 tons averaging 4 65 dwt. per ton. The yield by amalgamation and cyaniding was 43,150 oz., or 4 33 dwt. per ton, worth £180,619 or 18s. 1½d. per ton. In addition, 36,110 tons of old slime was treated, yielding 4351 oz. worth £18,198. The total yield was worth £199,099, and the working cost was £181,075; £6011 was paid as debenture interest, and £3147 as London expenses. There was an item of profit £10,184 from claim and township licenses, and on the other side £13,305 was allowed for depreciation of plant. The net profit was £6313, which, added to the balance brought forward from the previous year, made a total disposable balance of £86,921. The ore reserve on June 30 was estimated at 500,471 tons averaging 5 72 dwt., together with 186,419 tons of partly developed ore estimated to contain 5 89 dwt. These figures show a substantial improvement over those of last year. Since June 30, development on the 20th level has revealed the presence of higher grade ore, and the outlook is considered as greatly improved.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

Hardinge Conical Mill Co. advise that they have received an order from the Britannia Mining & Smelting Co. for five 8-foot Conical Pebble Mills, and one 6-foot Conical Ball Mill.

Deister Machine Co. have received an order for 68 machines comprising the full concentrating equipment for the Athasar Copper Fields, Ltd. The Geevor Tin Mines have decided, after trial of four Deister machines, to add 7 more immediately.

The British Humboldt Engineering Co. issue four separate pamphlets dealing with magnetic separators, and describing the different types required for feebly and strongly magnetic ore designed for either wet or dry work. The testing works of this company are equipped to determine the best machine for any kind of ore.

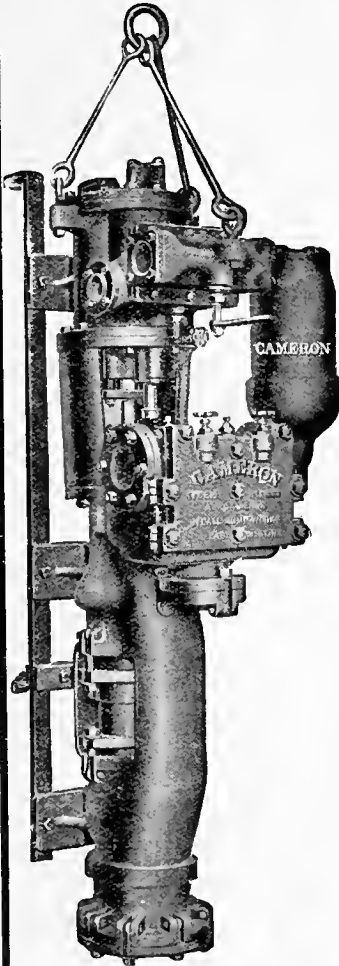
Sullivan Machinery Co. announce the appointment of Howard T. Walsh, European agent, as general sales manager, with headquarters in Chicago. Austin Y. Hoy takes Mr. Walsh's place in London. Other changes have been made to fill the vacancies caused by these promotions, which is in line with the general policy of The Sullivan Machinery Co. to promote employees who have served them with efficiency.

Holman Brothers, Ltd. new 62 page handsome catalogue is devoted to their mining specialities: Stretcher Bar Hoists, Diagonal Hoists, Electric Hoists and the Air Cushion Stamp. Much more space is devoted to the Stamp than to the other specialities, and important information regarding construction and details are given, which have not heretofore appeared. Holman Brothers have also reprinted in pamphlet form, Mr. Degenhardt's article on the Air Cushion Stamp, which appeared in the monthly journal of the West Australian Chamber of Mines.

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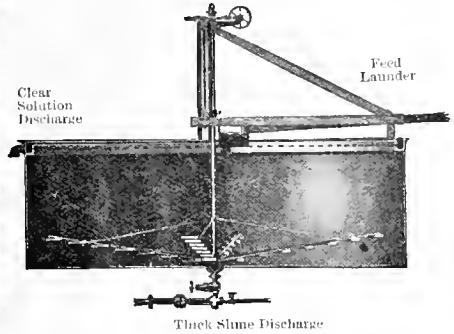
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MINERALS SEPARATION, LIMITED.

THE seventh annual ordinary general meeting of this company was held on December 20, at White Star House, Old Broad Street. Mr. John Ballet (chairman and managing director) presiding.

The Secretary (Mr. A. O. Williams) having read the notice convening the meeting and also the auditor's report.

The Chairman said: "As the directors' report and accounts have now been in your hands for some days, I assume it will be your wish to take them in. Before moving that they be received and adopted I propose, first, shortly to refer to the accounts, then to some what elaborate the report, and thereafter to give you some general information about the company's affairs and prospects at date, which I hope you may find of interest."

After analysing the balance sheet and accounts, the Chairman proceeded:

Our Australian company—the Minerals Separation and De Barvas Processes Australia Proprietary (Limited), was duly incorporated, and took over the Australian staff and business as from July 1, 1912, since when their operations have progressed, and are still progressing, very satisfactorily, with considerable additions made, as well as prospective additions in sight, to the number of import and licenses they already have. From the latest information received I estimate that their various licensees are already regularly treating at the rate of nearly, if not fully, 2,000,000 tons of zinc, lead, and copper ores per annum, and that further considerable tonnages from several important mines may be added thereto before long. You have probably seen the notice published in yesterday's papers that the Great Cobar Company has started our plant, the very first run being so successful that they claim a 90% recovery, and that plant will treat at from 150,000 to 200,000 tons a year to start with. An interim dividend by the Australian Company at the rate of 10% per annum has been declared by them for the first quarter of their existence, and I believe there is every prospect of similar quarterly dividends in the future, with perhaps a substantial addition at the end of each year. We are, as was expected from the first, working well together with the cordial co-operation of all parties, and we have every reason to hope and believe that the same happy condition of affairs will long continue, to our mutual benefit. With the exception of 5000 subscribers' shares (£15s. paid), since allocated to our agents in connection with the valuable services which they have rendered to your company since we commenced business in Australia, your holding in the Australian company remains undisturbed, and will, I hope, so continue so long as it is necessary for your company to retain the controlling interest. The whole of the money required to profit your participation in that company has been met from cash in hand. There remains, however, a call liability of 5s. per share on your remaining 39,400 subscribers' shares, amounting to £9,750, to be paid as and when required, and, of course, your option at par on 55% of the 35,000 reserve shares remains intact.

The Minerals Separation American Syndicate has, as they were entitled to, renewed their option for another year as from October, 1912. For this they have, in terms of the agreement, paid £5000. We have taken up a further 1625 "A" shares in the Syndicate, making our holding today 8125 "A" shares, and we have received a further 5250 "B" shares to equalize our holding and maintain our interest at about 65% in that undertaking. The general prospects of this subsidiary are exceedingly promising. In addition to several licenses already granted, large or continuous plant tests on very important big mines have been undertaken, and further contracts for similar large scale tests are in process of negotiation. The ores from all of the mines concerned have already given excellent results in small scale work, so that there is at present every reason to expect that the year 1913 may see very considerable and profitable developments in the North American business.

In Chile our test operations at the Braden Copper Company have resulted as satisfactorily as small scale work had led us to hope they would. The 240-ton per day test plant erected in their mill during the year, at our own expense, has not only justified all expectations, in spite of adverse circumstances, but the results have carried such conviction with them to the mineowners that, as you have been advised by circular, they have not only refunded us the cost of our plant and outlay on the test, but immediately ordered a 5000-ton per day plant to treat their whole mill output. The first unit of 60 tons per day started work about the middle of November, under temporary disadvantageous conditions, by taking only the fine slime product from their present type of mills. The second unit was expected to commence operating during this month, while the remaining 1500-ton portion will have to wait until the Braden Company has completed its full installation of secondary grinding plant. Until that is done it is obvious that the maximum recoveries will not be possible. In Sweden we have erected a plant at a well-known mine, and have the assurance that the owners are not only satisfied that all our representations have been fulfilled, but that they have been en-

abled, for the first time in 30 years of the mine's history, to make a handsome profit. The successful results on this mine are important because of the fact that other flotation methods had previously been tried without the same satisfactory result. Negotiations are in progress with various other important mines in different parts of the world, some of which have been examined on the spot, while others have had successful tests on bulk samples of their ores carried out by us in London with results on which we are prepared ourselves to erect plants if certain mutual terms and conditions can be arranged. I have good reason to hope that during 1913 our combined processes will be treating, in Australia and elsewhere, at the rate of between three and four million tons of ore per annum at least. By far the greater part of the increase will be derived from the treatment of copper ores.

The Australian amalgamation has not only settled all actions in that country to which we were direct parties, but it has, I think, made it more difficult for any one successfully to attack us, or our Australian company; and it has, I believe, greatly strengthened our combination against would-be infringers. The action brought against Mr. James M. Hyde (a former employee of our American syndicate) for infringing your patents at Butte and Superior, Montana, U.S.A., has been and is being prosecuted with vigour; voluminous evidence has been taken both in the States and in London. We understand that all evidence in the case has been closed, and that the actual hearing by the Federal Court at Butte, Montana, will take place towards the end of January or early in February, 1913. In the circumstances, therefore, it would not be right to say more than that our legal advisers have every confidence of a successful issue.

Research and experimental work has been carried on with excellent results, and various new patents have been taken out and applied for. Still further research is steadily proceeding, and our policy is to continue doing so without interruption. Plant has also been much improved and simplified, and we have every reason to believe that our processes have now reached such a proved commercial position, not only in their successful technical development, but also in the absolute certainty of their undoubted successful application on any commercial scale, that the practical confidence of the copper, lead, zinc, and silver mining industry will of necessity be extended to us in the future to a much greater measure than hitherto, simply because we daily, weekly, monthly, and yearly give economic results, wherever our processes are in operation, such as have not been possible by any methods heretofore known. Besides, the great mine owners and mining engineers to whom our processes have hitherto been unknown are at last beginning, in no uncertain way, to realize these incontrovertible facts for themselves. In the zinc industry users of our processes either as licensees of our company or of our Australian company are now producing high grade concentrates which contain at the rate of from one-fifth to one-quarter of the total annual production of that metal for the whole world. The contained lead and silver also produced by them from the same ores amount to very considerable quantities and values.

The next great industry to be still more largely affected and benefited will be that of copper. Some six or eight mines, several of them very important ones, are already experiencing the benefits of our process, and others have been convinced and are busy installing our plants, while still others are seriously investigating. The greater part of the world's copper metal, as you know, at present comes from the comparatively low grade but very big mines where concentration plays, and always will have to play, the most important part. At many of these mines they lose probably from 20% to 30% of the metal contents of their original ore. In many cases they lose more. When it is remembered, therefore, that in all these cases the costs of mining, milling, and recovery by present methods have of necessity to be paid for in any case, irrespective of the recoveries obtained, it will be seen at once that any extra recovery must mean extra profit, less the cost of getting such extra recovery. Now, if the cost of treating the whole of the crushed ore, slime and all, as produced by the mills, can be accomplished at but a fraction over the total cost of present methods, with the additional advantage of a substantial recovery of the extra 20% or 30% of values now running to waste, it is plain that considerable additional profit must result per ton of ore mined, milled, and treated, and a larger production must follow. We have demonstrated on a continuous and commercial scale than we can do save at least 55% of the sulphide metal contents of an ore, not to mention a higher grade of concentrate, and we can do that at an additional cost of not more than 5d. per ton of ore mined, milled, and treated, from an ore from which it has hitherto not been possible to recover more than 60% of the metal contents. The additional recovery of metal in this particular case amounts to over 41%, and figures at over 6s. per ton of ore with copper at £50. Suppose therefore that such a mine treated only 100,000 tons per day, then the total extra cost would be £20,17s. against an extra metal recovery of £300

per day, not even taking account of any saving in smelting charges because of the higher grade of concentrate.

The conclusions to be drawn therefrom are so self-evident that no further elaboration is needed. They were just the conclusions which, based on hard incontrovertible fact, forced themselves on the mine owners, and convinced them and theirs, and these same facts in greater or less degree, but still as convincing, will soon convince many others too, and that is, that by the use of our processes, where applicable, mine owners will be enabled to produce their copper from the same grade of sulphide ores hitherto treated for pounds sterling per ton cheaper than they have ever done before, simply because the ore will be made to yield a larger percentage of marketable metal, and, all things considered, that will, I believe, soon be secured at a trifling, if any, extra cost at all. This is my statement to you of what I believe to be the immediate and proved possibilities of our process, and it is also my message to the great copper mine owners of the world, who have not at present realized what we can offer them. We freely court their inquiry. It will be their fault if they do not do so. The zinc, lead, and silver mine owners of Australia have now for some time acted on these established facts, and they have not been disappointed. One mine alone in Australia, not to mention others, has netted a million sterling from its formerly nearly valueless zinc tailing by using our process. Before many years have passed Braden Hill shareholders alone will count millions sterling to the credit of their results simply from doing, or having done, the same, and the majority of the mines there are, as you know, already doing it so effectively that I had good reason earlier in my remarks to express our regrets for not having been able to secure any more tailings for ourselves on that field. Australia has been the first to benefit by our processes, but America is following fast.

By way of illustrating and supporting what I have said as to the efficiency, simplicity, and cheapness of our plant, I now propose, with your permission, to give you some practical and comparative figures carefully prepared by our chief engineer, Mr. Walter Broadbridge.

These figures are not mere irresponsible estimates, but they are, as closely as possible, based on established facts. In the most up-to-date mines of the U.S.A. and elsewhere, where several thousand tons of ore are treated per day, I understand the most modern practice is to erect complete self-contained units, each designed and equipped to crush and concentrate or treat about 1000 tons per day. Complete plans of such 1000-ton units have been furnished to Mr. Broadbridge, and on that he has based his figures, which, without troubling you with too many details, I have summarized as follows:—First, for an ordinary wet table and vanner concentration unit to treat 1000 tons per day there are in the particular mill referred to 174 tables and vanners, occupying a building or floor space of 41,518 square feet. The power required to drive these amounts to 175 h.p., and the cost of installation is approximately £25,000. This, of course, refers to the concentration plant alone, no crushing or power plant, with accessories, &c., being included. Secondly, to replace the above installation with a Minerals Separation Flotation Plant will require only two units of 600 tons each, capable of handling 1,200 tons of ore instead of 1000, and will cost about £4000. The housing or floor space required will be less than 3000 square feet, compared with 41,000 ft., and the h.p. to drive it only 80 to 120 at most, according to the number of agitators. The additional cost of suitable re-grinding mills recommended by us will at the outside amount to £6000. Adding this to the cost of M.S. flotation plant the total will then only amount to £10,000, compared with £25,000 for the former more unwieldy and less efficient installation. This extra re-crushing plant, it must be clearly understood, forms no part of the purely Minerals Separation process plant, although it is recommended and included because of the enhanced profit it will ensure.

To make this clear I will take a 2% copper ore, from which under the best table and vanner methods a possible 70% recovery may be assumed, so that with the copper at 12 cents the yearly yield will be from such a unit \$1,225,406, or £252,021. Against this an 85% recovery by Minerals Separation (because all values can be freed from the gangue by better crushing, thereby making the higher recovery easily possible), and assuming on a conservative basis that fully 50% of the crushed ore will need re-crushing at a cost of 30 cents per ton, and allowing also for the additional cost of smelting, the net results will work out as follows:—With copper at 12c, \$1,450,109, or £290,842, showing a balance of \$232,709 or £47,821 to the good, which again is equivalent to over 2s. 6d. per ton of ore net, or more than sufficient to amortize the whole of the cost of M.S. plant plus that of the extra fine crushing plant, in less than three months' operation. In other words, the copper produced from a 2% ore will cost at least one per cent. less per pound to produce, which again is equivalent to over £4 per ton of total metal won. The effect of this on the copper production of big mines and of the world, will be self-evident to you. In a mill handling 2,000,000 tons per annum, of which there are more than one in the United States and elsewhere, the two systems appear to be still more instructive and convincing. With wet or table and vanner concentration, a plant of this capacity would require 850 concentration tables and vanners, occupying a

floor-space of over 200,000 square feet, consuming not less than 870 h.p., with a capital outlay of at least £125,000. A Minerals Separation plant, on the other hand, to treat this quantity would only require 9 units occupying a floor space of not more than 15,000 square feet, would cost less than £20,000, and would require only 400 to 450 h.p. If it were found necessary to fine grind the ore an additional £30,000 should be added to the above figure, raising the cost of £50,000.

In capital outlay alone, the table and vanner plant would therefore cost 500% more than a Minerals Separation plant of equal capacity, or over 150% more than a Minerals plant, plus the additional re-crushing plant recommended. The production of copper, assuming 85% recovery (in many cases we have reason to expect and actually get recoveries of 90%), would be increased from 51,000,000 lb. to over 62,000,000 lb. The net saving would amount to £239,105, taking copper at 12 c. per lb. These figures speak for themselves. They may indeed appear to be sensational, but I have the fullest confidence in giving them, not only to you, but also to all practical and technical mining engineers conversant with the details. As far as we are concerned, in any case, we are prepared, subject to suitable arrangements and facilities, to make good this statement by undertaking to erect a 10,000-ton unit of our plant for the price named at the given mine with which the estimates have been compared, and to run it against an installation of tables and vanners of like capacity.

At the Braden Mines in Chile the whole of the 3000-ton plant is being built in that company's own shops on the mine, with the exception of some special bearings which were sent from England, not because they could not have been made there, but because they can be more readily made and delivered in less time by regular makers in England, simply because home manufacturers are specially equipped for producing such stock or standard requisites. The very important fact that our plant can be built on any mine, where there are only reasonable facilities, should make it most attractive to practical mine-owners and managers. It can also certainly and easily be maintained in perfect repair on any mine where timber and ordinary mechanical supplies, as well as carpenters and fitters, are available. These all-important considerations we unhesitatingly recommend to the serious attention of managers and engineers interested in mines likely to be concerned. In developing our process and plant, we have not, as indicated before, forgotten the careful study of the most economic and scientific method of crushing ores, simply because our processes have now so conclusively proved themselves to be capable of effecting so much greater recoveries of values than has been possible by the best known methods, that we soon recognized that much greater attention will in future be necessary to the more scientific reduction of ores than has hitherto been practised or possible. For zinc, lead, and copper sulphide ores, mining engineers, using the older methods of concentration, had in most cases to avoid crushing fine enough to liberate all contained values for fear of producing too much slime, from which it was practically impossible to recover the important values. It was therefore necessary to crush their ores in such a way as to make as little fine slime as possible, with the result that either the values were not sufficiently freed from the gangue, or they were lost in the slime. A loss, therefore, occurred both in the coarse and in the fine product.

All that can now be radically altered. We can and do recover the finest sulphide mineral from the finest slime pulp, so that the ore may now be crushed fine enough to liberate all values. At the same time, it is not necessary to reduce all the ore to slime. A happy and scientific medium can and should, therefore, now be adopted, and that method is to crush the ore just sufficiently to liberate all values, without having to overdo it. Our licensees and users of our process are already recognizing and practising this important fact, and I believe all practical men who may in future use our process will themselves soon realize that all-important fact, and that a further and necessary impetus will thereby be given to the perfecting of mechanical crushing or re-grinding devices on lines hitherto impossible because of considerations which have governed possible economical results. I think I have now tried your patience long enough with these somewhat technical details. They are details, however, which I believe will not be found uninteresting from a practical point of view and for that reason I hope you will not consider that your time has been wasted today.

The next subject I may be expected to refer to, although no mention has been made of it in the directors' report, such as I regret it myself—is the absence of a dividend. You will see the directors have not recommended any distribution. The reasons why they have not done so are because they believe that they have been able to make very much better use in your interests of the available funds. First, by protecting your interests in the Australian company so as to retain a controlling interest in it, and in doing that I know you will for reasons already outlined, readily admit that the board has acted wisely. Secondly, the means at their disposal enabled the board to maintain your proportionate holding in the American subsidiary. Thirdly, they have been able to undertake and carry out valuable exploration and test work, including the Braden test, in itself no small matter, as it involved the outlay of nearly £7000, the successful outcome

of which, however, will of a certainty have much greater and more far-reaching consequences than even the certain prospect of securing for many years to come from the company a substantial yearly sum in royalties. The further consequences and possibilities which may flow from the Board's results are so obvious that no enlargement of the report seems necessary. There are also a host of reasons which will be so self-evident to you as to call for no explanation, so that the Board can justly claim your approval of their good stewardship. The golden stream has been liberal, but, I believe, prudently sown on good and well-prepared soil, and will, I hope, if the weather only remains propitious, ensure the return to shareholders of a good and well-deserved harvest in due season. The strengthening of your company and the profitable extension of your business has been our chief aim and object, and I feel sure that we have not been unsuccessful therein.

For in what I know and believe the prospects of your company are, to say the least, very good, and, while I do not wish to flatter, I hope that it may again be my privilege to meet you next year to tell you, not only how far possibilities fore-shadowed to-day have been realized, but also to be able to say that even more has been accomplished. I much prefer to let such facts speak for themselves. It is also just possible that your directors may wish to consult you in special meeting during the early part of next year. In conclusion, I would ask you to accord or join the Board in according a hearty vote of thanks to Mr. Walter Broadbridge, your chief engineer, and to every member of your efficient and loyal staff, not only for the manner in which they have carried out their ordinary duties, but also for special services rendered you, both at home and abroad. Where all have done so well it is difficult to particularize. At the same time, I feel it my duty to mention the names of Messrs. A. H. Higgins and George A. Chapman for the ability and zeal with which they carried out special work entrusted to them, and on the recommendation of Mr. Broadbridge, of Messrs. Mowbray Jones and Henry Lavers for the good work they have done, and which Mr. Jones is still doing in connexion with the Braden tests in Chile, where he has been placed in charge of the building, erection, and operation of our 3000 tons per day installation. Mr. Lavers, after successfully carrying out the flotation part of the test at Braden, has returned to Australia, from where we had borrowed him for the purpose. I now beg formally to move the adoption of the directors' report and accounts as submitted to you.

Mr. H. A. Kitchin, in the course of a speech seconding the resolution for the adoption of the report and accounts, said: "Though here is standing to the credit of profit and loss a fairly substantial sum, the principle applicable to dividends, never before the directors conceived it to be in your best interests that they should hold that money back for the present, and employ it in furthering the interests of the company in various parts of the world. The chairman has spoken in glowing colours of the perfection to which we have brought our plant and our processes, and of all the enormous fields for their application in which we are opening up. No man is better qualified to speak on that subject than Mr. Ballot, and no man's words are better worthy of credence, because there is no living man who is so intimately acquainted with every detail of our processes from first to last, whether on the technical or on the commercial side, than Mr. Ballot. But this company is to Mr. Ballot what a very favourite or only child is to a doting father, and it is possible there may be some risk of his being carried away by his feelings and being a little over-rosy in his statements and over-sanguine in his prognostications. I will therefore, if you will allow me, lay before you the opinion of an independent critic. At the meeting of the Sulphide Corporation on December 19, the chairman, Lord Kinross, after dealing with the great improvement that had been shown generally in the production of the lead and zinc concentrates on the mine, went on to make this remarkable statement—

"The facts, gentlemen, and I think it is only fair that I should draw attention to it—that the Minerals Separation process which we use in our zinc mill has attained to a really very remarkable pitch of efficiency. For the whole of last year the recovery of zinc by this process averaged 50% against 85% in the previous year, while for the first five months of the current year it has further risen to an average of nearly 94%, and I do not think that anywhere else in the world, or by any other process, could these figures be equalled." Now that is the plain matter of fact statement of the chairman of that great mining corporation, which, I am glad to see, has reached the very satisfactory position of having paid its shareholders aggregate dividends of nearly £1,250,000, but that opinion, based on very large scale practical results, corroborates Mr. Ballot's statement on that side of the question—the zinc and lead side—in every respect, and the fact that his statements are confirmed and strengthened on that side must surely lend additional weight to the statements he has made to us with regard to copper. I feel sure, therefore, that you will go away to-day more convinced than ever, from what you have heard, of the magnificent possibilities that are in store for the Minerals Separation process. I have great pleasure in seconding the resolution.

The motion for the adoption of the report and accounts was then, unanimously agreed to.

GREAT COBAR, LIMITED.

THE fifth ordinary general meeting was held on December 30, at River Plate House E.C., Mr. Andrew Haes (the chairman) presiding.

The Chairman said that a great improvement had taken place this year, as compared with last. The tonnage for the year showed an increase over that mined and treated for the year previous; but, at the same time, it did not fulfil expectations.

Despite the various steps taken to secure sufficient men to fully man the properties, the shortage of labour complained of in the two years previous had continued practically throughout the year. He was glad to say that the general position of labour showed signs of considerable improvement, and the board considered the outlook more favourable for labour than it had been for some time past. They had hoped to have the Minerals Separation flotation plant completed in the latter part of August or September, but on account of their inability to secure sufficient mechanics, and the difficulty in securing supplies at the agreed time, this was impossible. Preparations were being made to supply the plant with 500 tons of Chesney ore and 200 tons of Cobar banded slates per day. They expected to derive from this source from 350 to 400 tons of copper monthly, leaving from 450 to 500 tons to be produced by the Cobar Gold and Cobar mines. This would give an annual production of approximately 10,000 tons of copper, with between 40,000 and 50,000 oz. gold and from 200,000 to 250,000 oz. silver. A cablegram had just been received stating that Mr. Faul, the representative of the Minerals Separation Company, was greatly pleased with the plant and the operation of the process. It added "Success absolutely assured. Smelting will commence January 6. All mines in good condition. Resume operations under greatly improved conditions. Tonnage of broken ore and value thereof best for the past twelve months. Situation generally satisfactory."

In seconding the resolution for the adoption of the report, Mr. F. A. Robinson said that the position had undoubtedly improved during the last twelve months. It had been a matter of surprise to him to see the attacks which were constantly made upon the Great Cobar company. For instance, the other day, he saw in one of the papers that it was officially stated that Mr. Bellinger, the manager at the mine, was going to leave the company. That was an absolute untruth; there was no foundation for such a statement as that, and why such a thing as that should appear in the newspapers, was beyond his comprehension. To begin with, Mr. Bellinger's agreement was not yet up with the company; it had some considerable time to run. Then they were told a little while ago that the bottom of the mine had fallen out, in other words, that the copper had come to an end. That was an absolute mis-statement, and all the reports which had since been received showed that that statement had no foundation in fact. Then they were told only the other day, after all the struggles that the directors had had, and after the manager had had in overcoming local difficulties, that the Minerals Separation plant had been found to be a complete failure. He could not understand how these reports got about. Mr. Bellinger was shortly to visit England, when they would be able to discuss with him all the matters connected with the future policy of the mine.

The resolution was carried unanimously.

NOURSE MINES, LIMITED.

(Incorporated in the Transvaal)

THE adjourned sixteenth ordinary general meeting of shareholders was held in Johannesburg, on December 4, 1912, Mr. H. C. Boyd in the chair.

The Chairman said that for the year ended July 31, the profit amounted to £243,200. Taken as a whole this did not compare favourably with the profit for the previous twelve months, being £75,25 less, but the more recent results reflected a position greatly changed for the better. During the first half of the twelve months under review, owing to unsatisfactory underground conditions, the tonnage crushed was low, costs were excessive and the profits were comparatively poor, averaging £18,429 monthly. In the latter months, many difficulties were overcome and the organization underground was greatly improved. There was a considerable increase in the tonnage crushed monthly, a steady decrease in the costs per ton, which for July were 20s. 7d. per ton, and a corresponding increase in profits, which for the last four months of the year averaged just over £25,000 monthly. There had been further reduction in costs during the current year, October showing the best results, 19s. 11d. per ton. By comparison, the reduction was actually greater than appears, as the development charge had, since the beginning of the current financial year, been raised by 6d. to 3s. per ton.

The year's profits had to meet heavy charges on capital account, amounting to just under £70,000, being the balance unprovided for at July 31, 1911, for special expenditure for the year underground and on the surface. It was with reluctance that the board decided to reduce the dividend declared in July to 5%, but the figures published at the time regarding the company's financial position must have made it clear that the decision was a wise one. It had been proposed to charge the cost of connecting the South Nourse shaft with the batteries, and the underground expenditure necessary for the general concentration scheme to capital account, as it consisted mainly of drives and connections off the reef which would not expose ore but would be in the nature of permanent passage ways. On further consideration, however, the Board decided to charge all this underground expenditure to working costs, and this course had been followed since the beginning of the current financial year. The actual expenditure on development for each month had been charged out, but if, for any reason, it had not been possible to accomplish work to the value of a sum equivalent to 3s. per ton milled, that amount had been charged against the month's profits. Owing to reduction in working costs this year, this additional charge had not been felt. Capital expenditure during the first quarter of the current year only amounted to £247, and there remained about £23,000 to be spent chiefly on the above-mentioned work in connection with the South Nourse shaft. As the manager pointed out, they intended, as soon as possible, to concentrate as much of the hauling as possible at this shaft.

In connection with the reduction in working costs, the chief economies had naturally been effected underground, where the bulk of the money was spent. In January it cost £38,400 to mine 61,780 tons, or 14s. 10d. per ton milled, while 67,196 tons were mined in October at a cost of £32,936, or 11s. 8½d. per ton milled. One of the main directions in which this sav-

ing had been effected had been in the cost of breaking ground by machines. During October it cost 5s. 3d. to break a ton of rock with large machines, a reduction of 1s. 2d. per ton compared with January, and small machines averaged 6s. 7d. per ton, less than half of what it cost in the beginning of the year. The tonnage broken by small machines in October was about three and a half times as much as it was in January; on the other hand, the large machine tonnage decreased by about 26 per cent.

Re-calculation of the ore reserves showed that at the close of the year the average value was the same as at the end of the previous year, namely, 6'6 dwt. per ton, but that there was a decrease of 81,705 tons. Proportionately, it was not a very large decrease, and it was more apparent than real. Areas formerly included in the reserves had been found in the course of mining to be cut off from the current workings by faults, and it was, therefore, considered wiser, temporarily at least, to exclude them from the reserves. Virtually, the position was much the same as at the end of the previous year. That it should be so must be considered satisfactory, for it was plain from the figures of recovery per ton that they had been mining a grade somewhat in excess of the average value of the ore reserves at July 31, 1911. This had, however, been counteracted by the fact that on the whole the values disclosed during the year had also been higher than usual. It must not be supposed that they had in any way strained after a high milling grade; they had taken the ground very much as it came. It would be apparent, now that working costs had been reduced, as they expected they would be, that they were in a position, while milling a grade more nearly reflected by the reserves, to make at least as good profits per ton as last year.

Of the principal features of the year's development work, probably the most important was the connection, by means of a long cross-cut on the 20th level, of the Nourse Deep and South Nourse Sections of the property. During the current year there had been no marked change in development results, which on the whole continued fair. Progress was being made with the concentration scheme underground, and it might be mentioned that even in the early stages improvements in the cost of tramping and shovelling ore were apparent, the tonnage handled per boy having increased by about 25 per cent during the past six months, the costs per ton showing a satisfactory decrease.

The consulting engineer stated in his report that a continuance of the improved profits earned in the latter months of the year could be reasonably expected, provided the labour force was maintained. Between July and October they lost 800 boys, and it was highly creditable to the management that profits were maintained so satisfactorily during that period, while development was in no way restricted. During last month the decrease really began to make itself felt. The actual numbers employed diminished seriously, and untrained boys took the place of experienced ones, with the consequence that only 51,300 tons were milled, a decrease compared with October of 5000 tons. There was every indication, however, from the present reports about labour that this was a passing phase, and they might expect to be provided satisfactorily in this

respect very shortly. In this connection it should be mentioned that they had joined the Native Recruiting Corporation, through the operations of which they anticipated considerable economy would be effected in the cost of procuring labour.

The Board wished to place on record their high appreciation of the services rendered by the consulting engineer, Mr. Madew, the manager, Mr. Barry, and Mr. Streetell, who acted while Mr. Barry was absent on leave. To them and the whole staff they were indebted for the marked improvement shown in the affairs of the company.

The Chairman then moved that the directors' report, balance sheet and accounts for the year ended July 31, 1913, laid before the meeting be received and adopted. Mr. E. J. Renaud seconded the motion, which was carried unanimously.

H. E. PROPRIETARY, LTD.

THE ordinary general meeting was held on December 10 at Salisbury House, E.C., Mr. F. H. Hamilton (chairman of the company) presiding.

The Chairman said they had not, during the past year, departed from the policy of marking time so far as their properties on the Murchison Range were concerned. The position on the Murchison Range had not exhibited any material change, but the Selau Railway was approaching completion, and, according to latest advices, had reached the Tzaneen estate on the Great Letaba River—a total distance of 310½ miles from Komatipoort—and should be completed during next year. So far, the advent of the railway had not been the signal for any fresh activity on the range, nor, so far as their information went, had the work prosecuted by local syndicates and others during the year been attended by any results which would lead them to modify their previously expressed conclusions. Their own work on the range had been confined practically to the maintenance of the properties. The Free State mine, in which they were interested as the largest shareholder and also by advances, had remained dormant. The mine was down to a depth of about 600 ft., and Mr. Froye had made an examination of the upper levels last year. He stated that although there were stretches of payable values, and that the winze between the first and second levels went down in 21 dwt. ore over a width of 56 in., he could not recommend restarting work on account of the irregularities of values. On the Bluejacket a tributor had been at work for the past few months and had produced a small amount of gold, on which they received royalty. A certain amount of work had been done during the year on Palabora, but the results did not afford sufficient encouragement to continue spending money. As regards the New Lisbon Berlyn Company, in which they had a considerable interest, it was satisfactory to note that the company had maintained regular crushings during the year, and had been able to pay off a small part of the loan which was incurred for the purpose of equipping the property with a reduction plant. The mining area of the company was a considerable one, and, while the gold occurrences were irregular, fresh discoveries were being made from time to time. It was also satisfactory that the management was hopeful of being able to deal in the near future with the pyritic ore, of which there were considerable quantities. Preliminary work had

been started on the Magato Concession by sending up a prospecting expedition, under the supervision of Mr. Calderwood, consulting engineer to the Messina Copper Company.

The time had come when it was necessary to take a broad survey of the position. Whether they should now embark upon an active policy of development on the Murchison Range or should adopt an alternative line would come up for decision in the early part of next year.

The motion to adopt the report was unanimously agreed to, without discussion.

KARAKA MINES, LIMITED.

THE first ordinary general meeting of the Karaka Mines, Limited, was held on December 20, at Salisbury House, E.C., Mr. W. H. B. Hope (chairman) presiding.

The Chairman said that they had done a good deal of work at the mine in New Zealand, and had bought an additional area of ground adjoining the properties of the company. In the first place, they had cleared out and re-timbered the whole of the Auckland level. That was an adit level, cutting the reefs at 600 ft., and had also driven on some of the reefs. They had also cleared the site at the head of the Gloucester shaft, which they intended to make the main shaft. They had bought and sent out the machinery, which consisted of air compressing, rock-drilling, hoisting, and an electric lighting plant. They had partly erected a set of machinery to work in conjunction with a five-stamp battery which was already there on another site a little distance off.

As they had not been able to commence crushing and to get the mine into working order, the vendors had met the board in regard to the payment of the balance of their cash consideration. To date they had paid them the sum of £2250, but, so far as the remainder was concerned, they were willing to wait until they got returns from the mine. They proposed to commence crushing about the end of January. The following was the latest cable: "Since we commenced driving on the reefs have now available Greenstone 1000 tons average value 17s. 8d., 3000 tons average value £10. Northeast branch 3000 tons average value £3. 4s. 9d. This will be in addition to quantities Dr. Simon estimated. Lucky Hit not possible to estimate until further advance. Have finished erection of machinery at the mouth of the shaft ready for driving the bottom level as soon as funds available. Reconstruction of battery, everything is well forward. Mill will commence running about the end of January. Late arrival of tube-mill will cause further delay. According to law, mines must shut down owing to the holidays fourteen days about Christmas time. Will cable assay results next Thursday.—DOUGALL." The assay results were received on December 19, and were as follow: "Assay results Greenstone north-east has advanced 8 in., average width 1 ft. 8 in., value 96s. 7½d."

In the past progress had been largely delayed owing to the bad season, and the weather which they had had there had been somewhat abnormal. They had actually had a fall of snow, which was almost unknown in the island, and heavy winds had from time to time stopped surface work.

The motion to adopt the report and accounts was carried unanimously.

HIMAN CONCESSIONS, LTD.

THE tenth ordinary general meeting was held on December 30, at 13 Austinfriars, E. C., Mr. W. T. Trevenen presiding.

The Chairman, after referring to the accounts, described the work accomplished by the West African Trust on the concessions which it had under option during the past year. The work was mainly confined to Bogosu North, Chujah, and Ekotokroo. In regard to Bogosu North, the development of this block had been made in conjunction with that of Botto No. 1, over which the West African Trust held an option. The so-called west reef, on this property, appeared to be a reef formation consisting of a great width of quartz veins and stringers. A certain amount of driving was done there at shallow depth, namely, 44 ft. The reef exposed averaged 25s. 9d. over 55 in. for a sampled distance of 180 ft. The east reef had been further developed in levels north and south at a depth of 100 ft., and the results obtained afforded encouragement to sink the shaft to a depth of 300 ft., for the purpose of opening out at that depth. The result here was very disappointing. A cross-cut west was put in, and, it was estimated, should have cut the reef at about 150 ft. This cross-cut, although driven 358 ft., only intersected barren stringers of quartz, and all work had been stopped.

In regard to Chujah, shaft No. 4 was sunk below water level, and the level opened out on the west reef at a depth of 200 ft. This reef, which was driven on north and south for a total distance of 161 ft., was found broken and of low value. Work at this point was stopped. An attempt to further develop the east reef near No. 4 shaft, which had been previously prospected by means of an adit drive, was made from the No. 2 shaft. The result was unsatisfactory. A cross-cut west was driven 276 ft. at a depth of 210 ft. This cross-cut failed to locate the reef disclosed in the adit level above, which showed some promise. A reef was encountered at a distance of 125 ft. in the cross-cut, and driven on north and south for a distance of 60 ft., but values were unpayable. A cross-cut east was extended to 252 ft. without result, and work was stopped.

In regard to Ekotokroo, various reefs had been prospected on this concession. The best results so far obtained were on a reef which ran right through the property and was believed to be a position corresponding with a continuation of the Prestea Block A reef.

The Anfargah interests presented a much brighter picture. The development so far had been practically confined to two reefs. On the A reef in the second level from the Beta shaft, latest assay reports showed a value of 68s. over 31 in. for 420 ft. in the north drive, and of 59s. for an average width of 26 in. for 350 ft. in the south drive. Putting these north and south levels together, a value of 64s. over an average width of 28 in. for a length of 770 ft. was recorded. The drive on the B reef, started from a cross-cut from the first level of the Gamma shaft, had been extended south for a distance of 173 ft. The reef met with in this drive was a fine reef of good value; 131 ft. sampled showed a value of 85s. 6d. over 80 in.

With regard to the Bogosu mine, during the year they had not been able to get out any scheme for the further working of that mine. It had now been shut down for some years.

The motion for the adoption of the report and accounts was carried unanimously.

EASTERN AKKIM, LIMITED.

THE second annual general meeting was held on December 19, at Blomfield House, London Wall, E. C., Mr. W. T. Key presiding.

The Chairman said that in the report they condensed in a few words the position and prospects of the company. These might be emphasized by mentioning some of the tests referred to. On the Asiakwa lease, the late J. H. Powell sluiced 50½ cu. yards of gravel for 1 6 dwt. per yard, and 600 cu. yd., including overburden, from 6 pits, for 20 oz., or 2s. 6d. per yard, and stated: "The extent of this particular alluvial area has not been determined. It is so large that only by a long and expensive system of prospecting could its limits be ascertained, but it has been examined sufficiently to prove that, with the plant proposed, there is ground sufficient for many years' work of a value equal to that sluiced." Mr. Saxton prospected the same ground last year for the company, and reported proving 290,400 cu. yd., worth 2s. 8d. per yard. This was the concession being equipped by the Asiakwa Alluvial Syndicate, and in their estimates of profits this value per yard was reduced by 40% to 1s. 7d. for safety's sake, with costs estimated at 5d. per yard. He also sluiced 67½ cubic yards for 1s. 2½d. per yard from the Kibbi Lands Concession, and 60 cu. yd. from Adadientem Concession for 1s. 3½d. per yard, in both cases including overburden and without treating the richer bottom gravels. He bored 37 acres with 27 bores, and after eliminating the coarse gold from boring, arrived at a value of 10d. and 1s. 1d. for 557,568 and 629,200 cubic yards respectively. On the Osino concession he reported that a native chief, with the aid of pumps, recovered 100 oz. from an excavation measuring 3000 cu. yd., and also that on their own territory four nuggets of gold from 1 to 1½ oz. were picked up by the natives during his stay. These values were payable and were communicated by Mr. Saxton in last year's report, copies of which were available, and he had summarized by saying: "the alluvials over wide areas and tested at long distances apart are of exceptional value." Of course mere gold contents did not make a payable proposition, but they were told that water was plentiful, that the contours of the country lent themselves to getting pressure by fall and a get-away for the tailing, and there should be no difficulty in recovering the gold. Mr. Saxton had demonstrated his confidence in the Asiakwa experiment by undertaking the management for a share of the profits. He was now busy erecting the plant, and his letters confirmed what he stated in last year's report. The future was dependent on the success of the syndicate, and when that was assured their large concession area lent itself to being subdivided into many sections for working by water power by various methods at no great capital cost. Meanwhile they held their property and awaited results, but recognized that the tests enumerated and other confirmatory reports warranted the belief that the company was proprietor of a gold alluvial territory of considerable dimensions. He did not think he need enlarge on the information given, which was built up from the actual work done on the property, and, of course had much greater value than any comments that the directors could make upon them. He moved the resolution: "That the report and accounts be and are hereby adopted."

Mr. Seymour Caldwell seconded the motion, which was unanimously adopted without discussion.

BROOMASSIE MINES, LIMITED

THE third ordinary general meeting was held on January 7, at Salisbury House, E. C., Mr. J. T. Currie (the chairman) presiding.

The Chairman said it was with no little satisfaction that the directors submitted their report for the twelve months ended September 30 last. The net returns from the mine amounted to £110,001, this included £110,412 from bullion recovered and the balance from concentrate. Against this, mining and treatment costs amounted to £54,033, and development redemption to £17,651. £9814 had been written off for depreciation of plant, machinery, buildings, and main shaft. The London expenses amounted to £3811, and debenture interest to £2762. There remained the substantial balance of £29,467, being profit for the year. Some critics had said that the costs were too high, but he would remind them that the Broomassie workings were deeper than those of any other quartz mine in West Africa, that the ore was derived from shoots, the occurrence of which was eccentric in the extreme, and that the principal orebody was remote from the shaft. Moreover, the ore was high grade, and every ton of it was removed. They could not afford to leave any pillars. The whole of the drifts had to be timbered and the stopes filled after the ore was extracted. The total working costs for the period covered by the accounts had been 31s. 10d. per ton, against 47s. 8d. for the previous year, and against an estimate of 35s.; and development redemption was 10s. 4d. per ton. Under the circumstances the costs compared well with those of any other mine in West Africa. They were hopeful that during the current year a still further reduction would be effected.

Since they last met the development of the mine had proceeded satisfactorily both as regards the results obtained and the amount of work done. During the period covered by the report, 4779 ft. of underground development work had been accomplished, against 4440 ft. in the previous year, the former including 258 ft. further sinking in the main shaft, against 71 ft. in the previous period. During the year the principal work, of course, had been in connection with the further development at depth of the rich ore-shoot situated 700 ft. or 800 ft. south of the main shaft. As in the last year, this shoot appeared to be dipping to the south, and consequently was getting in greater depth further away from the shaft. The length of the shoot at the 1170 ft. level was not quite so satisfactory as disclosed in the level above, but the reef at this level was somewhat disturbed by faults, which led them to hope that more settled conditions would be disclosed in the 1350 ft. level on which they were now driving. The results of the development below the fault pointed to this and were extremely satisfactory, the ore being of particularly good width and high value. In the bottom level—the 1350 ft.—they had driven in the pay shoot a total distance of 40 ft., where the reef was proved to be of an average value of 66 dwt. over an average width of 61 in., the full width not being exposed.

The result of the development work had been the addition during the year of 41,130 tons of west reef ore to the reserves, which at December 1, 1911, were 34,600 tons, and although they had passed through the mill since then 36,166 tons, of which tonnage 31,730 were obtained from the west reef, these ore reserves at December 1, 1912, amounted to 41,000 tons, showing

that they had more than kept pace with the mill requirements. When the estimate of the ore reserves was made at December 1 last, they had only just reached the pay shoot at the 1350 ft. level, so that every foot since driven had added to these reserves. Having regard to the occurrence of pay ore in the Broomassie mine and the comparatively isolated position of the present main shoot from the others which had been located, there seemed to be no reason why in other sections of the mine, and particularly to the north of the main shaft, pay shoots should not be found. In the early history of the mine one shoot known as Richards, to the north of the shaft, yielded a considerable tonnage of pay ore. Although there was an apparent tendency for the shoots to dip to the south, they took no chances at Broomassie, and therefore with a view to testing the ground to the north and below Richards' section, the country was being prospected by means of drifts along the formation. Although occasional values had been reported in the reef formation, no pay shoot in this section had been encountered. They regarded this work as of the very greatest importance, and the shareholders would readily appreciate the effect on the future of the mine if additional pay shoots could be discovered.

The main shaft was now down 1437 ft., or 87 ft. below the deepest level, so that they should soon be ready to open out at a depth of 1530 ft., which would be the horizon of the next level. The mine was well equipped, and they did not anticipate any serious capital expenditure during the year beyond that entailed in connection with the installation of the roasting plant, which should enable them to realize the gold in the concentrate more economically than by sending it to England for treatment. It was possible also that it might be deemed necessary to instal an aerial haulage scheme for the wood supplies.

Although the problem of the future of Broomassie continued to be as fascinating as ever in its uncertainty, they were in a better position today than they had ever been in the whole history of the mine. They had made profits before, and substantial profits too, but when these had been secured, they had either been at the end of the developed pay ore, or, at all events, seen the limits of the shoots so far located, and such profits had had to go back again into the mine to prospect in unknown ground for fresh sources of supply. Happily, these efforts had in the end been rewarded, and at last they were in the position of having accumulated profits, having substantial ore reserves in the mine, which were being added to daily; and although they could not speak with certainty, they believed they were some way off the limits of the present pay shoot. Besides, the mine was fully equipped with the plant and machinery capable of taking them to a much greater depth, and no serious provision had to be made under that head. They thought, therefore, the time had arrived when they could safely make a distribution to the shareholders. The interim dividend of 10% now declared should prove to be an instalment only on account of the profits they would be able to earn before September next, when the financial year closed.

The Chairman concluded by proposing the resolution that the report and accounts be received and adopted.

Mr. W. T. Trevenen seconded the resolution, which was carried by acclamation.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

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REVIEW OF MINING

INTRODUCTION.—When we went to press in January a feeling of general hopefulness prevailed in respect of the conclusion of peace between Turkey and the Balkan Allies. However, speculative dealings were held in abeyance for fear of the unexpected. Even the transmission of the collective note from the Great Powers, informing Turkey what was considered to be the logic of facts, failed to stir the markets. But a more cheerful view was steadily gaining ground, so that Paris bought Kaffirs and Rio Tintos, while New York bought back some of the railway shares it had previously sold. Signs of a rise were actually apparent on January 23, when it was made known that the Turkish Grand Council would accept the advice of the Great Powers. Then came the sensational news of the *coup d'état* at Constantinople, involving a sudden change of government, and the revival of a bellicose attitude by Turkey. The Paris and Berlin markets were much upset, although London remained unflustered. Even the final failure of the peace negotiations and the resumption of the war in the Balkans has not ruffled the share markets, it being apparent that the Great Powers are in agreement not to embroil themselves. It is also surmised that the combatants are nearly at the end of their tether, and that the fall of Adrianople, now daily expected, will lead to Turkey's acceptance of peace on the terms already specified. Fortunately the consistent prudence of our Stock Exchange has prevented anything like a panic. The mining market, except for the splash in Nigerians, is free from heavy commitments. On the whole, prices are steady, with signs of buoyancy in Kaffirs. Quotations are at a low ebb, and conditions, outside the effects of the war, favour a turn of the tide. The unexpectedly favourable change in the fortunes of

Associated Northern Blocks has stimulated the West Australian department. Nigerians are being worked for all they are worth. Broken Hill shares are healthy. Good rains have fallen in Queensland and New South Wales, ensuring prosperity to staple industries. Even the new outbreak in Mexico, announced as we go to press, has had no marked effect, probably because it is realized that affairs there must become worse before they are permanently better.

TRANSVAAL.—The December output of 776,406 ounces was the best since May and made a good ending to 1912. For the year the total production was 9,124,299 ounces, valued at £38,757,560. Thus the increase is nearly a million ounces in gold and £3,716,075 in money, bringing the total yield of the Transvaal to £363,884,635 since the discovery of the Witwatersrand in 1884.

The labour statistics for the end of the year were also good. As stated in our last issue, a gain of 4435 in December brought the total to 191,316, as compared with 197,937, the maximum attained during 1912, and with 178,282, the total at the end of 1911. The gain of 13,034 in the 12 months is satisfactory, so far as it goes, but it must be remembered that recruiting has been abnormally good recently owing to the drought in South Africa, compelling the natives to seek work on the mines. The gains of £55,154 in production and 8774 in labour, announced for January, are most satisfactory.

We have expressed the opinion frequently that the labour stringency on the Rand would be alleviated by the transfer of natives from exhausted mines to young enterprises. During the past month the City Deep received 800 workers, released from the Lancaster West, which has been shut-down.

The No. 3 shaft of the Consolidated Main Reef penetrated the Main Reef Leader at a depth of 2365 feet. Since then the ore has been exposed on three sides, being cut by a dike on the north side of the shaft. The average assay of numerous samples shows 17½ dwt. over a stoping width of 48 inches. This property is in the Western Rand, between the Consolidated Langlaagte and the Main Reef West. The shaft mentioned was started in October, 1910.

An over-wind at the Kimberley Roodepoort shaft on January 28 wrecked the upper portion of the head-gear and engine-house. This will prevent hoisting through the shaft for at least a month, and cause a reduction of one half in the tonnage milled during February.

A notable fall in Consolidated Gold Fields shares has been caused by the poor statement issued by its subsidiary, the South African Gold Trust. This, taken in conjunction with the last annual report of the parent company, led to an intelligent anticipation of the decreased dividend.

RHODESIA.—The December output of gold proved disappointing, for it was only worth £218,661, which is the lowest since the March preceding. A decrease of 17 in the number of productive mines is noted, the total falling from 188 to 171. The total yield of gold in 1912 is given as £2,707,368, which is the best recorded, but it is only £59,474 ahead of 1911. As compared to the optimistic forecasts and flamboyant promises of the Rhodesian controllers of mines, the result is depressing.

Cablegrams from the Shamva state that 30 feet of ore, averaging 11 dwt. per ton, has now been exposed in the cross-cut on the 4th level, and both faces continue in ore. It will be remembered that on the first level the ore was 110ft. wide; on the 2nd it was 97ft. wide; and on the 3rd, as far as known, it is only 27 ft. wide. The information given officially is incomplete and therefore untrustworthy.

According to Sir John Willoughby, the

chairman of the Chicago-Gaika, this company has "a valuable asset" in the Connemara mine. A long ore-shoot has been uncovered and 192,204 tons of probable ore has been disclosed. This ore has an assay-value of £298,840. Therefore it averages about 30s. per ton. Allowing for losses in milling and deducting the total cost—not the 'working' cost—this ore will yield only the narrowest margin of ultimate profit. It is a prospect, hardly an asset, except for a share gamble. Sir John said also that it was "an asset of great potential value." To this we also demur, for a real asset is not potential; it is a fact, not an expectation.

On another page we publish an interesting letter from Mr. H. T. Brett traversing some recent comment of ours concerning the metallurgical difficulties to be overcome in the treatment of the Cam & Motor ore, in Rhodesia. Incidentally Mr. Brett gives some interesting information concerning the cementing of ore in certain mills at Kalgoorlie during the early days of metallurgical evolution.

The dissatisfied shareholders in the Globe & Phoenix have not been united in their action, and the board has shown a conciliatory spirit. The directors have expressed their willingness to forego a part of their fees and Mr. J. C. Pitman has joined the board, in the place of Mr. C. F. H. Leslie. But this does not seem to have allayed dissatisfaction, for a requisition signed by the holders of over 100,000 shares has been lodged with the board demanding that an extraordinary general meeting be called to consider resolutions for the election of two new directors.

WEST AFRICA.—The Chamber of Mines gives 34,917 ounces, valued at £144,382, as the output of gold in December. This is the highest production in any single month, and brings the total for 1912 to 362,940 ounces, worth £1,497,179. Thus the increase is £427,737 as compared with 1911, and £741,244 as against 1910; in short, the output has just

been doubled in two years. That is a performance of which the Gold Coast can be proud. It is not all that the boomsters promised, but it is a highly creditable achievement, having regard to the obstacles against which progress has to contend in this least salubrious of gold-mining regions. In December an increased yield was scored by the Abbontiakoon, Bibiani, and Prestea.

The Abosso directors are to be complimented for their frankness toward shareholders. They notify their co-proprietors that the returns will be below the normal for the next two months, owing to the necessity for milling a large tonnage of low-grade ore that has been accumulated in the stopes.

AUSTRALASIA.—The Waihi continues to feel the effects of the labour troubles. Therefore, the directors deem it inadvisable to increase the output beyond 15,000 tons in each four-weekly period. [Why not fall into line with other companies and give returns in calendar months?] This 15,000 tons is to yield £25,000, which is enough, it is estimated, to pay a quarterly dividend of 1s. per share. Pumping operations are well in hand, so that exploration on the 10th level may be resumed in April. Thus a whole year has been lost. Incidentally, it is fair to ask why has there been so unwarrantable a delay in the publication of the New Zealand Geological Survey's report on the Waihi district? It is more than a year since it was handed to the Mines Department.

The rise in Ida H. shares is due to the finding of some rich ore and a new participation in the Taman oilfield. As the last spurt in these shares was due to high assays that proved delusive, it will be well to await further development by winzes.

Shortage of water has hindered the milling of ore broken in the Great Victoria mine, at Southern Cross, which is being developed for the Great Boulder Proprietary. The 2500 tons treated in November and December yielded £1360, the residue assaying 19s. 6d.

per ton. This means that the extraction was less than 35%, the ore averaging 30s. per ton. The result, we are told, is not deemed disappointing, as it was only a test, but it calls for an explanation.

The underground fire in the Consols mine of the Mount Elliott company will cause the temporary loss of a supply of ore chiefly valuable for its fluxing quality. A later telegram indicates that the fire is less serious than was supposed, so that sinking of the main shaft has been resumed. The dividend of 4s. paid by the Hampden-Cloncurry is a conservative declaration, and is important as being the first distribution by this company.

The Great Fitzroy returns for January are far from cheerful; the revenue from copper, gold, and silver, was £14,401, as against £14,456 in expenses. Even the holidays and torrential rains do not wholly explain the poor performance.

We understand that the independent report on the Great Cobar mines, made by Mr. C. S. Herzig, has been purchased by the directors for the Great Cobar company. Several copies are being circulated, but publication is being delayed until the arrival of Mr. H. C. Bellinger, the manager, who is due next week. The report is distinctly favourable, and the knowledge of it has already affected market quotations. The forecasts as to development and production are decidedly cheerful. Having regard to the facts of the case, it is a pity that the text of the report was not made known promptly to the shareholders.

Since our Melbourne correspondent dispatched his letter, the financial scheme for raising the capital required by the Broken Hill Proprietary Co.'s iron and steel venture has been settled, and the prospectus has been published concurrently in England and Australia. Contrary to expectations, the issue does not take the form of debentures; instead, 240,000 shares of 8 shillings nominal value are being offered at £2 each. In this way £480,000

will be raised. There remain 300,000 shares to be issued at some future date. The prospectus is endorsed by reports from Messrs. G. D. Delprat and David Baker, describing the project from the technological and economic standpoints.

The Royal Commission appointed to investigate the cause of the disastrous fire at the North Lyell mine, whereby over 40 men lost their lives, has not been able to fix any responsibility for the unhappy event, and the report is purely negative. It was held that there was no evidence of defective electric installation, and that neither the employers, the men, nor the men's check inspectors had ever contemplated the remotest possibility of such a thing as a fire. Recommendations are made with regard to legislation based on the experience obtained, but no opinion can be expressed until the full report is published.

UNITED STATES.—Our New York correspondent discusses the copper market. The set-back in copper is the result of over-production consequent upon the decreased consumption caused by the disturbance of industry arising from the Balkan war. It is also due to the success of the group of disseminated copper mines, which are fulfilling optimistic estimates of output.

The Guggenheims have acquired the Flat Creek property in the Iditarod district, Alaska. A 7½-ft. bucket dredge and electric power-plant belonging to the Yukon Gold Co. have been transferred from Bonanza Creek, in the Klondyke district, and erected on the Flat Creek property, which is on the Innoko river. This was done in 81 days, last summer; the removal started on May 23; the dredge was re-constructed and at work again on August 13. The weight of material was 800 tons; the cost of removal and re-building was \$120,000. The hull was divided, but the bow and stern were shipped entire. At the start, the dredge dug into tailing from previous sluicing operations, but when it got into new ground it is

said to have yielded (in September) \$82,000 worth of gold in 102 hours. Flat Creek is said to have \$5,000,000 remaining to be dredged. In the central Yukon region, a new district, known as Ruby Creek, is giving promise of importance. The mining is on a creek system entering the Yukon river from the south near Nulato, in central Alaska. The miners coming out of this district at the end of the season united in speaking well of the prospects there.

CANADA.—Our Toronto correspondent sends sundry news from Porcupine and Cobalt. During the latter half of 1912 the Hollinger produced \$933,973 worth of gold from 43,227 tons, the average assay-value of the ore being \$22.45, and the extraction 96.3%. This is a highly creditable showing.

The control of the City of Cobalt Mining Co., a Canadian corporation, is said to be under offer in London. The Government of Ontario has reduced the royalty payable by the Cobalt Townsite company to 12% of the profit. In 1911 it was 25%, in 1912 it was reduced to 17%, and then to 15%. Last year a total of \$95,000 was paid in royalty.

The high-grade mill at the Nipissing, described in our issue of last June, continues to be a metallurgical success. In 1912 it recovered 4,260,000 oz. silver for the Nipissing Mining Co. We understand that a similar plant for treating low-grade ore is now nearly complete.

RUSSIA.—The progress report by Mr. R. Gilman Brown recently issued by the Tanalyk Corporation indicates an interesting development, namely, the increased proportion of zinc in the ore. This necessitates a modification in the original scheme for smelting. Meanwhile tests by concentration are to be made, and a small reverberatory furnace is to be erected for the treatment of the less zinkiferous ore. This work is under the charge of Mr. T. W. Draper, who is further to have the advice of Mr. Theodore J. Hoover, who has a

special experience in the treatment of complex zinc ores.

From the Spassky it is reported that the orebody is opening up well on the 560-ft., or bottom, level of the Yuspensky mine. The drift has been in ore 30 feet east and 45 feet west. Both ends are still in ore, assaying 14% copper in the one case and 22% in the other for the width of the drift, and for a further width only partly tested by bore-holes. At the cross-cut the ore was 20 feet wide.

Further drilling at Kyshtim indicates that the Amerikansky orebody is at least 550 feet long at the 500-ft. horizon. The average of the last bore-hole, for 6½ feet, is 3·89% copper, 1·4 dwt. gold, and 1·36 oz. silver per ton. This is about the average of former results. The total production during 1912 was 7180 tons of blister copper.

MEXICO.—The manager of the Buena Tierra states that “everything is in a most unsettled state in Chihuahua.” The manager of another important mine, writing from Saltillo, in Coahuila, says that “nobody would suspect that the country was in a state of rebellion. We have not been molested at the mines this year, although scares are frequent.” This exhibits the diverse conditions obtaining in different parts of Mexico.

Since the above was written, the news of another revolution has come to hand. We discuss the subject on a later page. The engineers who went to examine the Campo Morado mine, for the Camp Bird company and others, were accompanied by an escort of 100 soldiers. One of the factors essential to this enterprise is the extension of the railway from Balsas. It is possible that the political disturbance may kill this business.

We note with interest that Dr. Hans Sauer is chairman of a new company formed, on the initiative of Messrs. G. A. Denny and H. S. Denny, to do business in Mexico. The company is called the Selected Mines of Mexico, and is capitalized at £100,000.

INDIA.—The Ooregum mine produced 2581 oz. less in 1912 than in the previous year, but the cost has been reduced substantially, as is the case at all the mines of the Kolar group, so that the yearly profit is likely to be maintained. The progress reports show that the lode at depth is narrow, though the assays are relatively high. At the +910-ft level in Oakley's section, the width is 18 inches, and the assays range from 26 to 30 dwt. per ton. In Taylor's section, development on the +610-ft. level discloses a width of 12 inches, averaging 1¼ ounces. Work in this section has been disappointing on the last few levels, and this discovery is the best recorded for a long time. Better news also comes from Bullen's section, where the lode had been lost in driving at the +310-ft. level; a cross-cut from the drift has now intersected the lode, and proved it to be 6 ft. wide and averaging 14 dwt. per ton. In the Anantapur district, the North mine is increasing its output and additional plant is being erected. The January figure was 815 oz. from 2151 tons by amalgamation. The cyanide plant is at work and the first clean-up will be made this month.

VARIOUS.—The Renong Dredging report is good. In January the yield was 48 tons of cassiterite, or 33¾ tons metallic tin. During the last half of the month the output was the largest recorded for such a period. Last year 682,986 cubic yards were dredged for a yield of 267 tons 13 cwt. of cassiterite, or 14 oz. tin per yard. The cost of dredging was 4·1d. per yard, and of this 1·2d. was expended in cleaning concentrate. The total cost in Siam was 6·07d. per yard, including the export duty, which was at the rate of 1·7d. per yard. The company has acquired additional ground, and has ordered a second Werf-Conrad dredge.

Despite the stimulus of a favourable metal market, the export of tin from the Malay States was only 48,260 tons in 1912, as against 44,149 tons in 1911. A larger increase might reasonably have been expected.

EDITORIAL

RAMSAY is the Barnum of science. We regard 'the birth of the atom' as an advertisement.

REDUNDANT DECIMALS are disappearing. The Globe & Phoenix management states the assay-value of the ore-reserve in pennyweights to one decimal, instead of three as formerly.

BULLFINCH shares have risen in anticipation of milling, which is due to commence now. Cheerful estimates of a yield of 60s. per ton, of a 'working cost' less than £1 per ton, and of a monthly profit ranging between £10,000 and £12,000 have been made officially. Beware of a wounded wild-cat.

WE NOTE that the *Mining and Engineering Review*, published at Melbourne, when referring to the standardization of technical usage and technical writing, states that "the Institution of Mining and Metallurgy, aided by *The Mining Magazine*, has, and is, doing good work in this connection." It is a pleasure to help the Institution.

THE ERROR made in cabling the assay of ore in the Victorious mine, of the Associated Northern Blocks, had no serious consequences, because it was so quickly corrected, but it illustrates the need for care in these matters. We wonder whether the manager of the Kuskie, in Nigeria, did not misuse his code-book when cabling that his samples "assayed 100 lb. per cubic yard." In any case, it is dangerous to use the word 'assay' in reporting a test by panning or 'calabashing.' 'Assay,' to most people, connotes a chemical test. In these matters forethought

is necessary. We remember an instance, far more fateful than that of the Associated Northern, of an engineer who when examining an Indian gold mine misplaced his decimal point, owing to a blunder in the use of his conversion table, and so made the mine ten times richer than it was. It is better to be sure than sorry.

INQUIRY into the Marconi affair has proved one thing at least, and that is the degradation of the Press through share dealings on the part of journalists. Several of the gentlemen who wrote most fiercely and with the greatest simulation of righteous indignation were 'bears' of Marconi shares. Unprejudiced judgment is incompatible with financial participation. On another page we publish a timely and forceful criticism, by 'Director,' on this phase of financial journalism.

COMPLAINTS come to us concerning a mixing of governmental functions with financial enterprise in Zambesia, a part of Portuguese East Africa. It appears that the Companhia da Zambesia, which occupies a position in this part of Africa somewhat analogous to that of the Chartered Company in Rhodesia, has lately transferred its mining rights to a new company, partly French, partly Portuguese, but registered in London, called Zambesia Mining Development, Ltd. This company sent a French engineer, Mr. Bernard Smol, and an assayer, Mr. J. W. Hill, to make a general tour of inspection, with a view to ascertaining if there were any mines or prospects in Zambesia that were worthy of acquisition; and if so, to make financial arrangements mutually advantageous. All this was well enough, as an expression of corporate enter-

prise, but, in order to obtain ready access to the mine workings, the inquisitive deputation was given official status. The engineer was made Inspector of Mines and was furnished at Tete with a document empowering him to act in that capacity. This document mentions the fact that Mr. Smol is a director of the Zambesia Development company and accords to him the authority to inspect in accordance with Article 141 of the Mines Law, September 1906. All of which is as amusing as a Gilbert & Sullivan burlesque, but it turns a serious aspect to English companies operating in Zambesia. They may not need financial assistance and they may resent the inquisition of a rival company disguised as a departmental inquiry. If the Portuguese government is to join a French syndicate with a view to acquiring the best mining claims, it is obvious that things may be made so unpleasant to an English company working in Zambesia that the latter might be compelled to cease operations and relinquish its property.

IN OUR LAST issue we referred to the difference in the yield from Crown Mines, Robinson, and East Rand shares, explaining that the difference, which is striking, was due to the varying expectations of life. The Robinson is an old outcrop mine approaching exhaustion; the other two are consolidations of groups of properties on a large scale. We made an error in giving the dividend yield of Crown Mines as 15% on the market valuation; it is 7½%. Crown Mines has issued 1,880,212 shares, having a par value of only 10s. each, but quoted at £7¼, so that the nominal capital is £940,106, and the market valuation, £13,635,162. The dividend for 1912 being £1,034,116, the yield is 110% on the capital issued, and 7½% on the market valuation. As regards the Robinson, this company has 550,000 shares of £5 each, which are quoted at £3½. The nominal capital is £2,750,000, while the market valuation is only £1,925,000.

Thus the dividend of £618,750 in 1912 represents 22½% on the capital and over 32% on the market valuation. The Crown Mines has a life estimated at about 40 years, while the productive career of the Robinson is expected to come to an honourable close within 6 years. Obviously, the Robinson shares are relatively low. A yield of 32% means the return of capital in three years, or capital with interest proportioned to risk in about 4 years; but among the resources is included the Main Reef proper, the profitableness of which is doubtful. The Crown Mines at 7½% gives a net yield (allowing for amortization of capital at 3%) of 6⅙%, which is attractive, even having regard to the usual mining risk involved and the debentures to be redeemed.

THE CONVERSAZIONE that celebrated the coming-of-age of the Institution of Mining and Metallurgy was a pronounced success. All the profession and his wife seemed to have been present at the Savoy on the evening of January 13. About 1000 persons participated. It was a notable gathering. We have a right to assume that the men were brave, for the women were fair, and arrayed as becomes the wives of those who direct the digging of gold and silver. The musical programme was varied and entertaining. Why then was the affair called a conversazione? Because, obviously, a conversazione is a contest between a concert and a conversation. In our quarter of the room, the latter had rather the best of it. Indeed one of the charms of a 1913 up-to-date conversazione is that you enjoy various forms of noise simultaneously. It is so stimulating, you know. However, even the most loquacious was plunged into a wondering silence when Mr. H. F. Marriott gave his exhibit of colour photography. This was astonishingly beautiful. The method employed is one whereby natural chromatic effects are reproduced by the aid of myriad minute particles that transmit the pri-

many colours, these multitudinous particles being spread upon the glass plate carrying the film. The process of development eliminates the particular colours that are not in the picture. The photographs that were shown had been taken on a whole-plate negative enlarged from a diameter of $8\frac{1}{2}$ inches to one of 11 feet, yet the detail did not suffer at all when the enlargement was thrown on the screen, which, incidentally, was an aluminium surface upon canvas. This demonstration, as we have said, was much enjoyed, for the natural scenes reproduced by the camera had been chosen with happy discernment.

The Mexican Crisis.

At the time of going to press the information available regarding the latest phase of Mexican unrest is incomplete. We only know that Felix Diaz, the nephew of the old President, has headed a revolution against Francisco Madero and the properly constituted government. This affair is an unexpected sequel to the former mutiny of the younger Diaz, who, it will be remembered, as lately as October captured the town of Vera Cruz in an effort to overthrow Madero. That revolt was promptly suppressed, Colonel Diaz was captured, and with his fellow officers was sentenced to death by a court-martial. He should have been shot forthwith, but President Madero hesitated to confirm the death sentence, fearing, so it is said, to arouse the friends of Diaz to further action. On February 9 a part of the army stationed in the city of Mexico revolted against the Government and released Felix Diaz, who was in gaol, and also Bernardo Reyes, who was in the military prison. General Reyes is the old commander-in-chief whom the elder Diaz sent into exile when he threatened to become a successful candidate for the presidency. The insurgents captured the arsenal, with its stores of ammunition, and attacked the National Palace, in which the President and his friends had taken

refuge. Reyes was killed in the assault, and so a picturesque figure has passed out of the current drama. It is reported that Madero has fled and that Diaz has proclaimed himself President; but it is also reported that Madero remains in control and that Diaz with his followers is on the defensive. It would be idle for us at this time to surmise the real course of events. Two things are obvious: Madero should have compelled Felix Diaz to take his medicine in October. The penalty for a revolutionist when captured is death, just as in whist a revoke calls for the loss of three tricks. That is one of the rules of the game. Being a sentimentalist rather than a soldier, the President hesitated to give effect to the sentence of the court-martial until so many days had passed as to make his consent look like personal animosity. He failed to play the game, that sanguinary game of revolution and counter-revolution, so he in turn has paid the penalty of seeing the former insurgent at the head of a part of the regular army in a second insurrection against the Government. Next, it is fairly obvious that either Madero will succeed in holding his own, and, having learned a lesson, will put down further disorder with an iron hand, that iron hand of which he has talked so much but has used so little, or else one of the many groups of brigands now rampant in the vicinity of the capital will shortly be looting his treasury and razing his palace. Another contingency is that Felix Diaz may succeed in wresting the presidency and in becoming a military dictator, after the fashion of his famous uncle and predecessor. On the whole, we deem it best that Diaz should succeed, because Madero has shown gross incapacity to meet the necessities of troublous times; and not only has Madero failed, but the people of Mexico have failed, also, for they have shown themselves recreant to the first duty of citizenship: to support a constitutional administration. They deserve what they will probably get, namely, the rule

of a military dictator, which, as far as we can see, is the only form of government suited to Mexico.

Dolcoath.

The premier mine of Cornwall has paid an increased dividend for the second half of 1912, making 4s. for the year. This dividend of 20% compares with 17½% in 1911 and 6¼% in 1910. It is due not to an increase of output, but to the higher price of tin. So far all are agreed. It is amusing, however, to read the various comments elicited by the higher dividend. The public is informed by one financial daily that "the reduction of the grade of the ore sent to the mill at Dolcoath is not necessarily obligatory, but is apparently rather a matter of policy." The management is supposed to be husbanding its resources, that is, to be keeping reserves of rich ore for a day when the price of tin is at a lower figure. Other commentators blame the directors for failing to rush the production while the metal market is so favourable. Here is a conflict of ideas. It should be obvious that rich ore yields most at the highest metal price; it would be more economical to sell the rich ore on a favourable market, and invest the proceeds, than to keep such rich ore in the mine as against a period of depressed metal markets. But all such comment is based on the supposition that Dolcoath contains large reserves of rich ore. This is a fallacy, for which there is no warrant. The manager, Mr. R. Arthur Thomas, and the directors generally have given the shareholders no excuse for such imaginations. What super-grade ore there is in the mine may affect the output for 15 months; that is all. No reason exists for expecting the price of tin to drop before that time has elapsed; hence it would be a mistake to dig the remnant of rich ore regardless of systematic stoping. Such a blunder is not likely to be made. The bottom level is looking poor; the only good ore cut in the deepest workings has been in patches; on the

whole, the exploratory work on the 3000-ft. level has been most disappointing. Indeed, the Williams shaft and its expensive equipment have been followed by no such developments as were reasonably expected. Apparently the orebody does not persist, and the question will soon arise whether to sink a prospecting winze or test the deeper ground by diamond-drilling. In view of these facts, the discussion over the "husbanding of resources" seems pathetic. For those resources are relatively slender. The time is not far distant when, at the normal rate of output, the ore remaining will have been exhausted and it will become necessary either to spend a large sum of money in prospecting or acquire new property elsewhere.

Arthur C. Claudet.

The beginning of 1913 has been saddened by the death of one of the most useful and influential of the mining community in London.



Arthur C. Claudet died on January 17, from an attack of pneumonia, at the comparatively early age of 57. As the eldest son, he inherited the assay business established by his father. He conducted it on the same lines, of skill and integrity, so that it continued to be profitable and renowned. As a graduate from the Royal School of Mines, in 1878, Arthur Claudet had been prepared to assist, and then to succeed, his father. He became

assayer to the Bank of England and to the Royal Mint refinery. He was one of the founders of the Institution of Mining and Metallurgy, and was honorary treasurer from its foundation in 1892 to the day of his death. In 1906 he was chosen as president. He was also the honorary secretary of the Royal School of Mines committee and took a large part in raising funds for the new club building. Mention of these details serves to bring out the salient fact in the life of one of the most kindly of men: Arthur Claudet was always willing to assist and to contribute to any cause connected with education and to further any plan for aiding technical students in starting a career. He participated in the work that led to the re-organization of the Royal School of Mines, the establishment of the Imperial College of Science and Technology, and the creation of the Imperial College Union. But the most important of his many benefactions was the endowment of a fund whereby graduates from the Royal School of Mines receive assistance, enabling them to take a post-graduate course of practical work at mines and smelters. This fund, to which Mr. Hennen Jennings also contributed, serves to supplement the scholarships given by the Institution of Mining and Metallurgy. It has proved of the greatest help to many young men. No one could wish to be better remembered than Arthur Claudet is today in many distant parts of the world, by young fellows to whom he gave a lift over that difficult gap intervening between the preparatory period and the professional career. He did this, and he did acts of kindness and helpfulness to scores of men, both young and old, to whom the vicissitudes of mining are a sad reality. Indeed, he was a helper, both among the straggling many and the successful few. His kindly presence was welcome whether at a public dinner or a private table. At the meetings of the Institution, as on other occasions when he was called upon to speak, his dis-

arming and discursive remarks won both consideration and respect. But behind that deprecatory manner was the constancy of purpose belonging to a man of strong character. He was courtesy itself, but without the weakness of mere amiability. Arthur Claudet was a man who had that rare faculty, the gift of friendship. To his friends, he leaves a remembrance to be cherished; to his sons, he leaves the heritage of a name honoured and beloved.

Nigerian Tin.

It is a pity that the real tin-mining industry of Northern Nigeria should be discredited repeatedly by technical blunders, reckless finance, and market manipulation. During the past month another feverish effort was made to stampede the public by kiting a few leading 'counters,' using the language of the Stock Exchange gambler. The chief lever used to lift quotations was the report of Mr. J. F. Balfour. This came by instalments, but not until Ropp shares had risen considerably. After his second cablegram, confirming the fact that the stuff he thought to be cassiterite really did contain $76\frac{1}{2}\%$ tin, the shares rose to £8. At the beginning of the year they stood at £2 $\frac{7}{8}$. Besides alluvial deposits, he announced the discovery of a lode, and ended his message with the words: "Deposits phenomenally rich." This is not the language to be used in the report on a mine. A phenomenon is an appearance beyond experience; the use of the word simply means that the engineer who uses it is completely at sea. He is facing something beyond the range of his experience. That being so, the less he says about it the better. Indeed, the unrestrained emphasis on the richness of the mineral discovery reminds us unpleasantly of the wild reports on the Jemaa, by the local manager for the Anglo-Continental, a buried fiasco on which Mr. Balfour himself wrote a final obituary. As the Ropp has a nominal capital of

30,000 shares, it was valued at £255,000 when the shares stood, during the current month, at £8½. This may seem small compared to the £2,500,000 added to the Anglo-Continental valuation during the Jemaa boom, but it is less excusable having regard to the lesson then administered. This Ropp incident, the granting of a lease to the Jos, the lecture on Nigeria at the Colonial Institute, and the sanguine comment made by a pronounced bull-operator were deemed collectively enough to cause renewed optimism, followed by ill disguised manipulation, on the market. Then came the Benue report by Mr. Wontner Brown, stating that the Gingia Hill alluvial deposits were "economically valueless" and that no sign of a tin lode could be detected. At the same time Mr. Brown said that the Bawa area would be ideal for dredging "were it not for the layers of stiff clay." Which is like saying that an ore would be ideal for smelting if it were not infusible. However, this report was timely in so far as it served to caution the excited people who were about to take the bit into their teeth and ride for another fall.

Nigeria is being over-exploited in London. More mining, more exploration, and more real work is needed before the tin industry can be legitimately used as the basis for a further expansion of quotations. Above all, it must be remembered that excessive speculation on the dangerous foundation of reports made by inexperienced men is mischievous in the extreme. Most of the opinions on which tall financing and share kiting have been based are not by men having the experience qualifying them for a sound judgment. Youngsters fresh from a school of mines are no more dangerous than older men accustomed to gold-quartz mining, but unfamiliar with tin deposits, and more particularly with the technique of tin-alluvial mining. The hysterical pronouncements of prospectors, mechanical engineers, surveyors, and others unfamiliar with the deceptive likeness of cassiterite to

ilmeneite, tourmaline, rutile, or garnet, have been fruitful of blunder. No less dangerous is the gold-placer miner who is not accustomed to the altered conditions involved in extracting tin worth 2 shillings per pound as against gold worth 80 shillings per ounce. The public should be warned, and not only the general public but also those more intelligent persons accustomed to regarding themselves as superior to the run-of-mine speculators. A series of valuable deposits, restricted in dimensions but sporadically rich, has been uncovered in Nigeria. This affords ground for a small but profitable industry, and for reasonable speculation, but not for the reckless gambling with which Northern Nigeria has become identified during the last two years.

Agricola.

The publication of an English translation of the medieval classic on the art of mining has been eagerly awaited. It is not only a book; it is an event. A review of a "labour of love," as the translators can with sincerity describe it, calls for an appreciation rather than a criticism. Indeed, the critical faculty is suffused by the glow of admiration for a task so courageously undertaken and so patiently performed. Again, one of the translators is a gentle lady, formerly a girl graduate from the same university as that to which her husband owes his degree of mining engineering. The combination of circumstances gives a touch of romance even to the ponderous tome in which the old burgomaster of Chemnitz relates how men have sought the ore and smelted the metals from time immemorial. To Mr. Herbert C. Hoover and to his accomplished wife we tender our hearty congratulations, and not without an *arrière pensée*, for when such ephemeral institutions as the Bank of England and the London Stock Exchange have served the purpose of a passing day, it will be recorded that the first English translation of DE RE METALLICA was "Published for

the Translators by *The Mining Magazine*" in the year 1912.

Heretofore the mention of Agricola, and the occasional quotation of some of his statements regarding the ancient and honourable art, has been the privilege of sundry gentlemen of simulated erudition. When they addressed a school of mines, or even a Royal School of Mines dinner, they mentioned this 16-century authority with an allusive touch, invariably eliciting general admiration. That cannot happen again. They will have to dig deeper henceforth. For now the great book of George Bauer, to use his real German name, is available to all who have a spark of intelligent curiosity. And when they read the lordly folio they will abate their modern conceit, for they will not go far into the translation before they realize how broad a basis of sound observation was laid by a man who wrote long before even the atomic theory was promulgated. They will appreciate "the length and breadth of the subject," as the author states in his dedication to the dukes of Saxony. They will realize that the art of mining is "one of the most ancient, the most necessary, and the most profitable to mankind." They will appreciate how much this venerable textbook illuminates a point of view so unfamiliar, and they will wonder why we have had to wait 356 years for a rendering of the original into our own language. The original text was written in Latin and printed in 1556. A year later the first German translation appeared. This was followed in 1580 and 1621 by other German translations, all of them badly done. In 1563 an Italian translation was published. Thus DE RE METALLICA has appeared in Latin, German, and Italian. In 1636 an Englishman, Sir John Pettus, wrote concerning a translation he had made, but it was never published, and diligent search has failed to unearth any trace of the manuscript. In later days other energetic persons have essayed to translate Agricola

into English, but none of them fulfilled the purpose. After an eager beginning, and a successful tussle with the first chapter or two, the translator has become hopelessly discouraged by finding a number of words coined by the author to express ideas unknown in Latin and therefore not to be found in any dictionary. A group of technical men at Butte, Montana, began a translation in 1903, but desisted when this obstacle proved too much for them. The task called for initiative, persistence, and systematic preparation. These qualifications were brought to the work now under review. Some of the ambiguities of the Latin terminology were cleared by careful reading of the context and by means of an incomplete glossary left by Agricola himself, but the main attack had to be made by the use of a library of contemporary literature germane to the subject and collected by the present translators. By digging and prospecting amid these incrustated deposits of obsolete writing, the translators discovered a clue to most of the obscurities in the Latin original. Even then the translation had to be made with an eye to avoiding the employment of such modern terms as involved scientific conceptions non-existent in the sixteenth century. The task was to translate decadent Latin into modern English without allowing the new medium of thought to colour the old ideas. On a faithful adherence to this guiding principle, the value of the translation depends. We believe that a careful reading of the big book will prove that this has been done, and well done. We agree with the translators that "the work serves to strengthen the traditions of one of the most important and least recognized of the world's professions." They place the 'if' of modesty before the words we have quoted and conclude that "if the work" does this, then they will be "amply repaid." That consummation of their labours is reasonably sure. Agricola is the book, literally the bible, of mining. The recognition of the antiquity,

not of the mere occupation but of the intelligent art informing a basic industry, may serve to promote a larger regard for the dignity of that profession to which the translators claim to be devoted. The literature of the subject has undergone a secondary enrichment of extraordinary value. Hoover has made Agricola famous.

The Radium Hunters.

When high science is mixed with low finance the result is confusion. The marvels of radio-activity are so little understood that to most people the subject is a sort of modern alchemy, over-riding all their elementary notions of chemistry. A little learning is made to leaven a large mass of pretentious ignorance. The association of radium with uranium minerals is a fact, but all uranium compounds do not contain radium, and when they do contain it, the proportion is subject to no law as yet discovered. Moreover, when radium is finally extracted, there is no ready sale of it. Hence the sport of the radium-hunter is not suited to joint-stock finance. However, it appears to be admirably adapted to a pseudo-scientific exploitation of old mines and new simpletons, as is illustrated by the South Terras flotation. Of this issue many things might be said, but we cannot spare the space to dissect its many flagrant absurdities. The scheme is a loud echo of previous efforts in a similar direction, such as have involved Sir William Ramsay's repeated loan of his scientific reputation to reckless company-mongering. His example has been followed by sundry French savants, including the lady who through Becquerel, was enabled to win fame by the separation of radium from pitchblende and other uranium compounds. Madame Curie is most unfortunate in having her name dragged into the South Terras flotation. This abandoned mine was sold at auction in 1911 for £3100, and is now capitalized at £200,000, in 50,000 shares of £4 each. Moreover, 5000 shares

are now offered, not without the sounding of tom-toms and the emission of fireworks, in the spacious advertisement columns of the daily press, at £5 each, although an official circular states that the mine has at least £1,516,000 worth of radium, not including its "merchantable" radio-active water and an array of by-products having names that sound like prehistoric reptiles. Among the sponsors of the scheme are four Frenchmen, of whom it may be presumed in all kindness that their knowledge of business is inversely proportional to their scientific attainments. Among the English directors is the usual histrionic nobleman whose part it is to shed a phosphorescent lustre on the title-page of a prospectus. Then we come to Mr. Sydney Fawns, M.I.M.M., and Mr. Arthur W. Wells. The last was formerly the London secretary of the Hawthorne Silver and Iron Mines, the directors of which are now being tried for fraud in the United States. Mr. Fawns must know this; and he must also know that the promoter of this South Terras affair is a man named Frank S. Gray, who previously has been identified with several issues of a disastrous character. In any case, the report made by Mr. Fawns, like that made by Mr. James Thame, M.A.I.M.E., is not in accord with the standards of the profession. At the time of their inspection the mine was full of water; therefore the examination was a farce. Mr. Fawns quotes samples assayed by Mr. Benedict Kitto, who is in no way to blame, but Mr. Fawns does not say whence these samples came. He assumes that the rich assays obtained therefrom indicate the value of the concentrated product to be derived from the operation of the mine. On this flimsy basis, he proceeds, piling one assumption on top of another, until finally he forecasts an output worth £5200 per week. The question of cost is dismissed summarily without any estimate being given. It is not too much to say that this report by a member of the Institution of

Mining and Metallurgy constitutes a scandal. When a reputable member of the profession does this sort of thing, it is futile to criticize Dick, Tom, and Harry for vagaries and aberrancies. This is the feature of the South Terras affair that we consider the most regrettable.

Associated Northern Blocks.

The recent rise in the quotations expressing the market valuation of this company's property is a cheerful episode. It is based on realities. A few months ago the shares were quoted at 4s. 1½d., which was the lowest price in 1912; during the past month the quotation reached 23s. 6d.; twelve years earlier it rose to £4. This company, therefore, has passed through vicissitudes of fortune. It was organized in 1899 to acquire the Iron Duke leases, at Kalgoorlie, and immediately north of the Oroya-Brownhill. The famous chimney of ore in that mine passed at an angle of about 22° through the Iron Duke leases into the Oroya Northern ground, and in passing through the Associated Northern property it yielded handsomely for a few years. In 1911 the company acquired the El Refugio in Zacatecas, Mexico, but this promising mine is shut-down at present owing to the brigandage incidental to a so-called revolution. At about the same time the company purchased 72 acres, constituting the Victorious mine, in the Ora Banda district, in Western Australia, and about 35 miles from Kalgoorlie. This property was acquired in 1911 for £22,500 cash. Mr. Herman Landau is chairman of the company, and Mr. George M. Roberts, formerly at the Associated, is resident manager. The Iron Duke workings are mainly in the hands of tributors, a sign that the company cannot expect much more ore from them. The Victorious mine, according to the annual report to the end of September last, had about 200,000 tons of probable ore above the third level. This averaged 20s. per ton. The

mill started in September, but the results in the remaining months of last year were hardly up to expectations, the filter-presses working badly, so that the yield fell to 18s. 9d. per ton. The outlook, therefore, was not cheerful. Early in January, however, a sensation was caused by the publication of a cablegram stating that ore assaying £82 per ton had been cut in the east drift on the No. 4 level. This proved to be an error in codifying; it should have read 82 shillings per ton. However, the blunder was soon mitigated by further high assays, disclosing the fact that an orebody of undoubted richness had really been found. A succession of cablegrams sent the shares to 23s. 6d. on January 28. Since then they have dropped first on profit-taking, and then on less favourable news. The drift at the No. 4 level, which is at a depth of 360 feet, was in good ore for 190 feet, the first 95 feet averaging about 50s. per ton for a width of 4½ feet, while the last 95 feet of the drift averaged 245s. for an average of over 5 feet. Farther east the drift penetrated disturbed ground and low-grade stuff. Two rises have been started, and so far, they are in ore similarly rich. A couple of winzes will, we presume, be sunk shortly to test the downward continuation of the orebody. Until this has been done, it is dangerous to make estimates. The chairman, at the annual meeting on January 29, spoke with commendable caution concerning the recent news from the mine. The Ora Banda district is well regarded by those who know the local conditions, it being believed that the orebodies give signs of more persistence than is usual in Western Australia, outside the Kalgoorlie district. The new orebody appears to overlap the one previously mined and may extend behind the existing stopes. At the present quotation of 15s. per share the property of the Associated Northern stands at £262,500, as against about £54,000 in cash, its Refugio mine, the gleanings to be gathered from the Iron Duke, and the ore in

the Victorious. These together warrant a total valuation about equal to the market appraisal. A few weeks should serve to disclose the real character of the new find at Ora Banda. It remains for us to congratulate Mr. George M. Roberts, the manager, to whom this happy crisis in the affairs of the company is largely due.

Mining on the Rand.

Now that the official statistics are available, we can analyse the performance of the mines of the Witwatersrand in 1912. A summary of the essential figures is given here-with :

	1912	1911	1910
Tonnage milled	25,243,143	23,888,260	21,974,358
Total yield of gold	£35,980,193	£33,543,479	£30,705,089
Average yield per ton	28s. 6d.	27s. 11d.	28s. 6d.
Nominal profit per ton	9s. 10d.	9s. 7d.	10s. 7d.
Nominal cost per ton	18s. 8d.	18s. 4d.	17s. 11d.
Dividends	£7,993,790	£7,755,997	£8,908,546
Ratio of dividends to 'profit'	64%	63%	77%
Ratio of dividends to output	22%	23%	29%

It will be noted that the tonnage was increased by 1,913,903 in 1911 and by 1,354,883 in 1912. The output of gold increased in value by £2,838,390 in 1911, and by £2,436,715 in 1912. Both in tonnage and output a considerable expansion has been maintained. The average yield per ton for 1912 is the same as in 1910. The decline evident in 1911 has been stopped by 'selective' mining methods, that is, by greater care not to break waste. The so-called working profit has not been increased correspondingly, for while it is 3 pence more than in 1911, it is 9d. less than in 1910. This is due, of course, to an increase in the working cost, which, despite a bigger tonnage, has been creeping forward. It is now equivalent to 4'38 dwt. per ton. However, these figures of 'cost' and 'profit' are phantasmal, as is shown by the dividends, which represent the net resultant profit to the shareholders. The dividends in 1912 are £237,793 higher than in 1911, but they are nearly a million pounds less than in 1910. How illusory this so-called profit is, is shown by the figures ex-

pressing the relation it bears to the dividends. In 1910 only 77% of the 'profit' reached the shareholders; in 1912 the ratio fell to 64%. Finally, the ratio of dividends to output exhibits the fundamental economic relation of work to results. The purpose of mining is to make money for the owners of a mine.

Mining at Cobalt.

The directors of the Cobalt Town Site and the Casey Cobalt mining companies are to be congratulated on the account they were able to give their shareholders at the annual meetings. These assembled at the same place, on the same day, under the presidency of the same chairman, and were duly recorded on the same page of the next day's financial paper. Thus it was a twin affair concerning which it may be said that mother and children are doing well. To Sir Augustus Fitz-George it must have been an agreeable task to preside, and to the real sponsors of the enterprise, Messrs. W. R. P. Parker and J. P. Watson, the occasion was something of a personal triumph. We do not view it askance; on the contrary, it is heartily refreshing to read the accounts of two enterprises in which British shareholders are faring so well. It is true that the early hesitation to participate in mining adventure in the Cobalt district was justifiable, for most men of experience feared that the excessive richness of the ore betokened a shallow and a sporadic distribution of the silver. Events have proved that such timidity, although reasonable, was exaggerated, for the mines of Cobalt have prospered exceedingly and the exploitation of them has enriched many people, notably a dozen men who have become dollar-millionaires. Even after the district had passed the first stage of immaturity, it was held that the geological conditions were unfavourable to the persistence of the ore in depth, for the veins appeared to become impoverished when they were followed below the diabase and the Huronian conglomerate into the Keewatin schist.

At the Casey Cobalt meeting it was asserted by Mr. Parker that rich ore had been followed in the Beaver mine down to 700 feet, through the Keewatin and into the diabase. This is most interesting, but it does not stultify the views of authoritative geologists. On the contrary, it is in accord with the views expressed by the late S. F. Emmons, by Mr. Willet G. Miller, and by others who have studied the local conditions. They have held that the veins were enriched when in the diabase or near it, so that the significant feature of the Beaver discovery is not that the ore is in the Keewatin but that the Keewatin is traversed by a deeper sill of diabase, producing conditions found favourable elsewhere in the district. However, it is gratifying to learn that such conditions are repeated in depth. While 700 feet is not really deep, to the eye of modern mining, it is so much farther from the surface than the shallow workings of the bonanza zone as to be highly encouraging to those who propose to explore farther. We have never been at all inclined to disparage mining at Cobalt; it has been conducted with an energy and a skill highly creditable to our Canadian friends, and it promises to be a profitable industry for many years to come. The gentlemen in technical control of the two British-owned mines are well equipped by experience to advance the interests of the shareholders. It is true, the veins are as small as they are rich, and for that reason their continuity may be precarious, but with vigorous extension of the workings and reasonable caution in the estimation of ore, the Casey Cobalt and the Cobalt Town Site companies ought to be able to make a highly creditable record.

While favourably impressed by the information available concerning these two companies, we deem it well to warn the public against other issues now being offered. For example, the Cobalt Lake. Shares in this company are being sold at double their par

value, on a capitalization of £300,000. Even if the ore in reserve in December contains, as is stated, 2,121,610 ounces of silver, it is absurd to value the property at £600,000 or \$3,000,000. Two million ounces of silver will not yield more than 30 cents per ounce of ultimate profit, so that the profit assured is only about \$700,000 or £140,000. This is not nearly enough to warrant a market valuation of £600,000. On January 9 the mine was valued on the Toronto market at 48 cents per share, or £330,000 for the property. It is only speculative excitement that has nearly doubled the valuation since then. The prominent directors are Sir Henry M. Pellatt, Sir Augustus Fitz-George, and Lord Camoys, none of whom have any special qualification for appraising mines. The other members of the board include several gentlemen connected, as is Sir Augustus Fitz-George, with the Cobalt Townsite and Casey Cobalt companies. It would be a pity if these two apparently worthy enterprises should be used as a means of foisting mere gambles on an excited market. Another share quoted is the Aladdin Cobalt. No real information has been given concerning this mine, although share dealings were started in London last October. A big rise has been manipulated recently, so that the £1 shares stand at 3½, on the strength of the purchase of some adjoining property, concerning the real value of which nothing definite is known. As we have said, we are not inclined to depreciate the Cobalt mining industry, and fully recognize that it may continue to have a profitable career, in which British enterprise may take part advantageously. But we give one piece of advice: not to go deeply into any of these Canadian flotations, especially when endorsed by titled gentlemen of meagre experience in mining, unless reliable information is forthcoming. By reliable information, we mean the report of a reputable and experienced mining engineer not participating in the profits of promotion on the London market.

PERSONAL

JAMES ALLEN will be known to those who were at the Royal School of Mines in 1885-1886. He is now Minister of Defence and Finance in the New Zealand government, and as Col. the Hon. James Allen is now in London.

R. T. BAYLISS has returned from Mexico.

J. W. BOYLE, of Dawson, is here.

COREY C. BRAYTON has returned from Nome to San Francisco.

C. B. BRODIGAN is returning to Johannesburg shortly.

C. T. BRODRICK is economic geologist to the Tanalyk Corporation.

H. KENYON BURCH is now with the Inspiration Copper Company, Arizona.

W. J. CLARKSON is the new secretary of the South African Institute of Electrical Engineers.

S. H. DE LA MARE has left for Manchuria.

G. D. DELPRAT now has his headquarters at Melbourne.

SIDNEY DYER has resigned as consulting engineer to the Susannah Mines, Rhodesia.

MATTHEW FRANCIS, manager for the Benue, is expected in London from Nigeria.

ALEXANDER FYFE has left Cobalt to accept an appointment as metallurgist to Compañía Minera y Exploradora de Ventanas, in Mexico.

A. H. HARDMAN is acting manager for the Renong Dredging Co., in Siam.

C. S. HERZIG will lecture on the sampling of mines before the Sir John Cass Institute, beginning on February 27.

STANLEY HODGE has been appointed resident manager for the Dominion Gold (Rhodesia) Company.

H. C. HOOVER has been elected a member of the board of trustees of Stanford University, California.

J. POWER HUTCHINS has returned to St. Petersburg.

J. H. LEVINGS is undertaking prospecting work for the Tasmanian government on the west coast of the island.

W. J. LORING has gone to Burma.

GERARD LOVELL, recently at Toronto, is in the Northern Shan States as the representative of Bewick, Moreing & Co.

V. F. STANLEY LOW left for St. Petersburg on January 31, and will be in Russia for two months.

MALCOLM MACLAREN, who was recently married, is now in Burma.

J. E. MAGUIRE has been appointed manager of the Wolhuter.

FRANK NICHOLLS, the manager for the Renong Dredging Company, is on his way back to Siam.

WALTER G. PERKINS sailed on February 14 on his way to Famatina, in the Argentine.

EDGAR RICKARD sailed for New York on February 9.

H. M. RIDGE was recently at Frankfort.

ANDREW ROBERTSON is retiring from the management of the Wolhuter mine, a position he held for nine years. He will in future devote his attention to farming.

W. S. ROBINSON is on his way to Melbourne.

N. L. SATOW, recently with the Randfontein Central, is in London.

BASIL SAWYER has been appointed manager of the Mount Lyell, in Tasmania.

A. R. SAWYER has returned to Johannesburg.

W. J. SHEPHARD is returning to Northern Nigeria to superintend the erection of the new plant at the South Bukeru.

W. EVAN SIMPSON has returned from Guerrero, Mexico.

CARADOC JAMES, manager of the Abosso mine, West Africa, is in London.

ROBERT STICHT, the general manager for the Mount Lyell company, will in future live at Melbourne, and BASIL SAWYER will be resident manager.

NORMAN C. STINES left for Russia on February 6, upon his appointment as mining engineer to the Sissert company.

LESTER STRAUSS has returned from Bolivia to Lima, Peru.

J. W. H. STUBBS has resigned as one of the technical advisors to the General Mining and Finance Corporation. ROBERT PILL is now sole technical advisor to this group.

G. W. THOMSON is in London from Porcupine.

A. N. C. TREADGOLD, of Dawson, is here in his capacity as managing director of the Granville Mining Company.

WILLIAM TRURAN, on his return from the Argentine, has accepted the local management of the Spanish Goldfields.

J. B. TYRRELL sailed for Canada on January 17.

A. C. VEATCH and ROBERT ANDERSON have entered into partnership, with London offices at 53 New Broad Street.

H. C. WOOLMER, manager of the Spassky, is returning to Siberia.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Jan. 1913	Dec. 1912	Jan. 1912
£71. 18s. 6d.	£75. 12s. 2d.	£62. 17s. 6d.

The long struggle between producers and consumers has at length ended in a victory for the latter. After maintaining for months their quotations of 17½c. and £82 for electrolytic copper without marketing substantial quantities, the American refiners were forced to get rid of some of their accumulations. They found, however, that the users were by no means ready to relieve them of the burden of carrying stocks, which in normal times were kept on consumers' premises; and prices having proved to be vulnerable, buyers are encouraged in their determination to limit purchases until outside influences are sufficiently settled to remove the check upon the world's progress. Electrolytic copper has been sold as low as £74, although the latest quotation shows a recovery to £76. That the position of trade does not warrant so severe a drop is shown by the orders for manufactured copper taken since the decline. English works declare they have never been so busy, and new orders keep rolling in. Rumours come to us of a fall in German demand, and Austrian trade is of course crippled by political disturbance. On the other hand, American railway electrification schemes on an immense scale are being prepared, which will eventually create an enormous demand. In the meantime the appearance of the market is discouraging for holders. The only demand is for spot supplies and that is urgent. The speculative medium has shown wide and violent fluctuations in anticipation of the cut in producers' prices, even verging on panic.

TIN.

Average prices of cash standard tin :

Jan. 1913	Dec. 1912	Jan. 1912
£228. 5s. 0d.	£226. 17s. 8d.	£191 14s. 0d.

In striking contrast with the depression ruling in other metals the price of tin has been well maintained. Market sentiment has been mainly bullish, although tinplate makers complain of curtailment of business through the war. Much has been made of the excess of consumption over supplies, but the high price ruling for so long has certainly stimulated the search for fresh sources of supply, and it will be surprising if a larger output does not result within a reasonable time. The present level is

distinctly artificial, and it remains to be seen how long the bull party will be satisfied to support prices. They succeeded for a short time in squeezing bears for cash tin and making them cover at £232, but since then prices have fallen and the market has the appearance of weakness. The Banca auction realized an average price of nearly £229, a surprisingly favourable figure.

LEAD.

Average prices of soft foreign lead :

Jan. 1913	Dec. 1912	Jan. 1912
£17. 1s. 11d.	£18. 1s. 6d.	£15. 11s. 3d.

This metal has shown marked weakness, and although it has rallied occasionally, the improvement has been fitful. This is due to large arrivals from Australia, and to the heavy commitments of the dealers. For the time of year, trade is brisk, thanks to the open weather. Consumers would be well advised not to speculate on a further drop. Continental demand is good, especially for Russia.

SPELTER.

Average prices of good ordinary brands :

Jan. 1913	Dec. 1912	Jan. 1912
£25. 19s. 1d.	£26. 0s. 4d.	£26. 9s. 11d.

The market is steady but quiet and buyers are reserved. The London market has been depressed by occasional offers of forward delivery at prices under the ruling rates. Manufacturers are busy on old orders, but complain that new orders are not coming forward. For 1912, the exports of galvanized iron amounted to 658,688 tons, which constitutes a new record. The syndicate decided not to alter prices in January, as the statistical position is satisfactory; but it will doubtless find it necessary to be more accommodating in the near future.

OTHER METALS AND MINERALS.

Prices quoted on February 10 :

SILVER.—28¾d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £90 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£35 to £36 per ton.

QUICKSILVER.—£7. 15s. per flask.

MANGANESE ORE.—10d. to 1s. per unit.

IRON ORE.—Cumberland hematite 26s. 6d. per ton at mine. Spanish 23s. delivered in England.

PIG IRON.—Cleveland 65s. per ton. Hematite 83s. per ton.

WOLFRAM ORE.—33s. per unit (1%).

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

WASHINGTON.

Mineral Production in 1912, according to figures compiled by the bureaus here at Washington, reached record figures in several instances. According to E. F. Burchard of the Geological Survey, the iron ore mined amounted to between 54,000,000 and 57,000,000 tons as compared with 43,550,633 in 1911, and probably will be found to have exceeded the record of 56,889,734 tons in 1910. Reviewing the year in the *Mining and Scientific Press*, George H. Cushing points out that heavy drafts were made on stock piles as well as mines; and that blast-furnaces are now working well up to 80% of their theoretical capacity, or, in fact, about to their actual capacity. The *Iron Age* states that the increase in pig iron production amounted to 6,000,000 tons, a total of 29,750,000 tons as against 23,649,000 in 1911, and a record of 27,303,000 in 1910. Steel ingot production, which is perhaps even more significant, was close to 30,500,000 tons as against 23,676,000 in 1911, and 26,095,000 in 1910. Already the air is full of rumours of new works, and not only is the United States in full tide of production, but another period of expansion has seemingly begun. It is a matter of much remark that this has come despite a presidential election, a political upheaval, and another impending revision of the tariff. Prosperity that can persist against such a combination of proverbial bugbears would seem to be well founded.

Copper Production has also increased materially. Monthly figures published by the Copper Producers' Association are now widely available and need not be reviewed. They indicate a refinery production of 1,572,500,000 lb. The smelter production, including 'Lake' and blister copper, is estimated by B. S. Butler, of the Geological Survey, at 1,249,000,000 lb. Both figures show an increase over 1910 and 1911, an increase all the more important because of the higher prices realized. The surplus copper stock increased 19,000,000 lb. in December, and despite the healthy demand for metal a policy of curtailment may soon be again necessary. There is considerable new production to be taken into account, not so much from new mines as larger output from those now operating. For example, the Braden, which yielded 9,000,000 lb. in 1912, may

be expected to produce 40,000,000 in 1913. The Utah Copper, Nevada Consolidated, Chino, and Ray increased their output by 68,000,000 lb. in 1912, and Ray and Chino at least will probably double their production this year. The Anaconda mines are credited with 294,700,000 lb. in 1912 as compared with 260,000,000 in 1910, and, reinforced by the Tuolumne, Pilot, Butte, and other Montana properties, may confidently be expected to yield even more in 1913. The Giroux, Granby, Shattuck-Arizona, and other companies are preparing also for larger production. Altogether it may prove necessary to try the effect of slightly lower prices in stimulating consumption, or of curtailment of production before the present year is out.

Lead and Zinc industries enjoyed unexampled prosperity in the year just ended. Aside from large production and good prices, a feature of the year was the almost complete disappearance of stocks. On December 31 the smelters had on hand just 4208 tons of spelter and less than 10,000 of lead.

The production of primary spelter from domestic ore in 1912 is estimated by C. E. Siebenthal, of the U. S. Geological Survey, at 323,961 short tons, and from foreign ore at 14,669 tons, a total of 338,630 tons, worth, at the average St. Louis price, \$46,731,000, compared to a total of 286,526 tons in 1911, worth \$32,663,964, and made up of 271,621 tons of domestic origin and 14,905 tons of foreign origin. The production of spelter from both domestic and foreign ores, apportioned according to the states in which it was smelted, by six-month periods, was:

SPELTER PRODUCTION, 1911-1912, BY STATES.

State.	1911.		1912.	
	First half.	Second half.	First half.	Second half.
Illinois.....	41,255	41,875	44,224	44,065
Kansas.....	50,574	47,839	52,485	48,376
Oklahoma.....	19,997	26,318	36,010	41,584
Other states....	28,370	30,298	33,777	38,109
Totals.....	140,196	146,330	166,496	172,134
Yearly totals	286,526		338,630	

The imports of spelter were the largest for many years, being estimated at 10,700 short tons, valued at about \$1,202,000, compared with 609 tons in 1911. The imports of zinc dust were 2350 short tons, valued at \$262,700,

against 1713 tons in 1911. Exports of domestic smelter are estimated at 6673 short tons, worth \$871,479, compared with 6872 tons in 1911.

The total production of refined lead, desilverized and soft, from domestic and foreign ores in 1912 is also estimated by Mr. Siebenhal to have been 480,965 short tons, worth at the average New York price \$43,286,850, compared to 486,976 tons in 1911 and 470,380 tons in 1910. These figures do not include an

doubt that Missouri retains first place among the lead producing states. The imports of lead are estimated at 10,969 short tons of lead in ore, valued at \$452,650; 76,468 tons of lead in base bullion, valued at \$3,452,750; and 266 tons of refined lead, having a value of \$20,000; a total of 87,703 tons, compared to 89,952 tons in 1911. Of the 1912 imports, 85,000 tons, or about 97%, came from Mexico. The exports of foreign lead (lead of foreign origin smelted or refined in the United States) show

GOLD AND SILVER PRODUCTION IN THE UNITED STATES.

State or Territory.	Gold				Silver.	
	1911.	1912.	1911.	1912.	1911.	1912.
	Fine oz.	Value.	Fine oz.	Value.	Fine oz.	Fine oz.
Alabama	890	\$ 18,400	855	\$ 17,674	200	237
Alaska	806,179	16,665,200	841,674	17,398,946	468,300	516,224
Arizona	170,348	3,521,400	159,807	3,303,504	3,228,900	3,456,989
California.....	964,041	19,928,500	966,943	19,988,486	1,270,900	1,255,192
Colorado	925,839	19,138,800	909,049	18,791,710	7,331,200	8,350,316
Georgia	1,548	32,000	478	9,881	600	65
Idaho	65,688	1,357,900	63,077	1,303,917	8,184,900	7,703,721
Illinois.....	—	—	—	—	4,000	3,740
Maryland.....	5	100*	—	—	100 [†]	201
Michigan.....	—	—	—	—	507,700	543,360
Missouri.....	—	—	15	310	49,100	25,311
Montana	176,554	3,649,700	156,507	3,325,287	12,163,900	12,338,589
Nevada	875,438	18,096,900	644,920	13,331,680	13,185,900	13,042,118
New Mexico.....	36,847	761,700	29,265	604,961	1,341,400	1,251,412
North Carolina.....	3,478	71,900	6,906	142,760	1,000	3,783
Oregon.....	30,679	634,200	30,515	630,801	44,800	79,896
Philippines	9,448	195,300	19,362	400,248	3,100	5,650
Porto Rico.....	97	2,000	—	—	100	—
South Carolina.....	972	20,100	754	15,587	—	40
South Dakota	359,402	7,429,500	377,116	7,795,680	200,300	200,796
Tennessee.....	576	11,900	473	9,881	107,000	109,773
Texas.....	189	3,900	492	10,170	444,200	420,994
Utah.....	217,020	4,486,200	211,736	4,376,971	11,630,600	12,795,072
Virginia.....	150	3,100	424	8,765	200	7,974
Washington.....	40,635	840,000	13,789	285,044	230,300	258,152
Wyoming.....	1,030	21,300	1,107	22,884	700	298
Totals.....	4,687,053	\$96,890,000	4,435,270	\$91,685,168	60,399,400	62,369,974

* Maryland and Pennsylvania.

estimated output of 13,384 tons of antimonial lead, against 14,078 tons in 1911 and 14,069 tons in 1910. Of the total production, desilverized lead of domestic origin, exclusive of desilverized soft lead, is estimated at 229,765 tons, against 201,223 tons in 1911; and desilverized lead of foreign origin comprised 81,649 tons, compared to 94,143 tons in 1911. The production of soft lead, mainly from Mississippi Valley ores, is estimated at 169,551 tons, compared to 191,619 tons in 1911. Despite the reduced output of soft lead, there is no

a decrease of more than a third, being estimated at 65,253 tons, against 101,227 tons in 1911.

Gold and Silver figures are less encouraging. The statistics, collected jointly by the Bureau of the Mint and the Geological Survey and reproduced above, show a decrease in gold, due mainly to the smaller output at the Goldfield Consolidated mine. That great property is being worked at full capacity, but at deeper levels the grade of the ore is so much less as to be reflected seriously in the total output even of so large a gold producer as is

the United States. Silver on the other hand increased 2,000,000 oz., the larger output being very generally distributed.

Philippine matters come up for much quiet discussion at present. It will be remembered that the Democratic party, which will be in control after March 4, has pronounced in favour of Philippine independence. Just how far its leaders will go when faced by the actual responsibility, is uncertain. Contrary to opinion frequently heard abroad, there is no fixed determination on the part of the American

sentimental and the fact that the venture has not paid serves to influence many. If there could be any assurance that an independent government in the Islands would be honest and efficient and at the same time maintain itself, there would probably be a nearly unanimous vote in favour of ordering our own officials home. The American policy has consistently looked toward such a final outcome. The practical problem is whether the time has come to fix a date when the Islands will be wholly handed over to a native government,



COLUMBIA MINES, SUMPTER, OREGON.

people permanently to hold the Philippines. The general attitude, it must be said, is one of indifference. There is a sense of pride of achievement and a latent but strong determination not to be forced into action. At the same time powerful motives operate to favour the grant of independence. In the first place, there is the sentimental feeling that all men should take equal part in our government, faced by the admitted fact that only a minority of the Filipinos are now prepared to do so. In the second place, the adventure into colonization was accidental and the cost has been heavy. The American is practical as well as

and if so, how soon the transfer should be made. Sentiment among those who know the situation best is adverse to any such present action, but it is not likely to control. In the meantime, figures for the year show an increase in gold production from 9448 fine ounces to 19,362 in 1912, and word comes from Manila that the first of the large California-type dredges has been started at Paracale. Its work will be watched with interest since the field is one previously monopolized by the New Zealand builders, who have, in truth, shown much more enterprise in entering it than have the Americans.

SAN FRANCISCO.

Oil-flotation. The adoption of the Minerals Separation process by the Britannia Mining & Smelting Co., which operates in the New Westminster district of British Columbia, is the first overt evidence of the important progress which is being made in the adoption of flotation in metallurgical practice in America. The Britannia is a good property, but thus far the ore has proved too refractory to permit operation with much success. The ore consists of silicified schist, impregnated with chalcopyrite and pyrite. An enormous amount of experimental work has been done with ordinary wet methods and also magnetic concentration. The Crofton smelter was built in 1902, about 50 miles from Victoria, to handle the ore from this mine, but production was suspended in 1907. More recently the concentration plant was re-built, and concentrate has been shipped to the Tacoma smelter while experiments with the Minerals Separation process have been in progress. The present mill will be re-built to include Hardinge mills for grinding preparatory to flotation, and it is reported that later another 1000-ton flotation plant will be built. At Butte an interesting competition has been in progress between the Minerals Separation company and the American company controlling the MacQuisten tube concentrator. On the site of the old Butte Reduction Works, which was burned down some time since, there is a large accumulation of copper tailing, estimated at 1,500,000 tons, containing 1% copper, and an extensive series of tests is being made to determine which process will give the better extraction. No conclusion has yet been reached. It is reported that a number of other copper companies are giving careful attention to the possibilities of flotation in eliminating the present losses in slime tailing, and it is not at all improbable that a good deal of progress will be shown during the year. At the Braden, in Chili, flotation makes a high recovery, over 80%, on ore that only yields 61% by ordinary wet concentration, and the 600-ton unit will be enlarged until a total capacity of 3600 tons per day is reached. It is interesting to note that the Braden ore contains carbonates, and the recovery by flotation upon the sulphides is over 90%. If similar results can be obtained in the United States, the speedy general adoption of flotation methods is likely to follow. The application of flotation to copper ores is of special interest, since it was at first assumed that only those sulphides which are not easily oxidized are amenable to flotation.

Thus blende was thought to be easily concentrated, while copper sulphides, in which the grains of mineral are often coated with a film of oxidation products, could not be easily floated. Experiment has shown this *a priori* reasoning to be incorrect. The forces that cause one mineral to float while another sinks are as yet incompletely known, and only an actual test will reveal whether the ore can be concentrated by flotation or not.

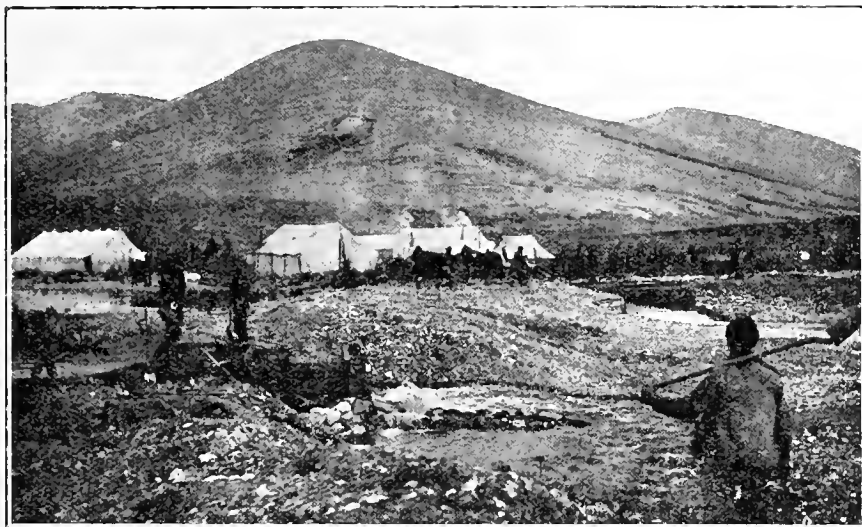
It may be worth while to refer to Wood's flotation methods, as they are evidently unknown in England, since no reference is made to them in Hoover's recent book on flotation methods. The inventor, H. E. Wood, of Denver, has worked out a method quite similar in principle to the MacQuisten tube, but using different apparatus. He floats sulphides on an air-water surface without the use of acid or oil, and in the simplest type of apparatus the dry-crushed ore is gently dropped on the surface of a moving current of water; the sulphides float and are carried off by the current, while the gangue is discharged through a spigot at the bottom of the compartment. A more elaborate construction employs an endless belt dipping beneath the surface, which picks up the floating sulphide and elevates it to a concentrate-laundry. Sometimes a little oil is used to facilitate flotation, but no acid. This apparatus avoids to some degree the handicap of the MacQuisten tube, though it does not possess anything like the area of flotation surface available by other methods. On the other hand, it introduces a serious handicap of its own in the fact that once a grain of sulphide has sunk below the surface there is no means to bring it up again and afford it another chance to float, if it will. For this reason the method scarcely seems likely to be a success in practice, while the expense of fine dry crushing and the drying of tailing before re-treatment are other serious handicaps. Mr. Wood has also found that with certain sulphides, notably those of copper, particles which would float when first crushed will sink after standing a few days exposed to the air, making re-treatment of tailing correspondingly difficult. It does not seem probable that the process will have much commercial importance, but since Mr. Wood has a number of patents, his work is of corresponding interest.

The apparent success attending the application of flotation methods to the treatment of copper ores is likely to discourage experiment with leaching methods, which are already sufficiently discouraging because of their mani-

fold minor difficulties. Nevertheless the Bullwhacker Mining Co. has built a 50-ton unit at Butte to carry on experiments with the leaching of copper carbonates and silicate with H_2SO_4 solution. The method seems simple, but the 'joker' in operation is in the precipitation of the copper. It is proposed to do this by electrolysis, and electrolysis of a dilute copper sulphate solution containing an excess of H_2SO_4 is quite a different matter from the electrolysis of blister copper in refinery vats. In one case the current breaks up a concentrated solution which constantly maintains its strength by dissolving the anode, in the other

method of heap-roasting in which the heaps are sprinkled with $FeSO_4$, $NaCl$, or both, followed by leaching and precipitation. Iron has been used for precipitation but its consumption, from the presence of free acid and ferric sulphate in the solution is almost prohibitive, even when the iron is produced by reducing iron oxide in a small furnace, without fusion.

The Laist process, devised by F. W. Laist to treat the ore of the Big Indian mine in Utah, but never operated, has been the subject of experiment in the Washoe smelter, at Anaconda, for some time. It involves roast-



A PROSPECTOR'S CAMP IN ALASKA

the problem is to completely remove the copper from a dilute solution which as it becomes poorer in copper develops a higher and higher resistance. The construction of the anode is also a problem, for graphite will not stand the attack of sulphate solutions and no satisfactory substitute for it has been found. It is evident that the Bullwhacker is not yet out of the woods. The Butte-Duluth Mining Co., recently organized to take over a group of claims east of the East Butte and near the Bullwhacker, is reported to be about to build a 100-ton unit of a 500-ton leaching plant, but presumably construction will be delayed until experiments at the Bullwhacker have been completed. The Shannon Copper Co. has done much work on leaching, but makes no official statement of the results, which are popularly supposed to have been unsuccessful. J. W. Bennie, the superintendent, has patented a

ing the tailing with fuel and salt, and leaching with sulphuric acid made from the roasting of concentrate. The copper will then be precipitated from the sulphate solution by H_2S generated by the action of H_2SO_4 on crushed matte, thus precipitating the copper and regenerating the acid, so acid consumption would be cut down to the mechanical loss from wastage of fowl solutions. Only prolonged experiment will serve to demonstrate whether the process can be worked at a profit or not, and while the Anaconda company makes no official announcement it is generally known that results so far have been encouraging. The Bradley process, of which Thomas Lawson is the godfather, C. S. Bradley the inventor, and A. C. Burrage the 'angel,' is represented by a 500-ton plant which started work on the Anaconda slime-tailing over a year ago, but shut down after treating a few

tons and has been idle practically all the year, though it is recently reported that it will soon start again. The ore is first roasted in tremendous rotating cylinders, 90 ft. long, something like a cement kiln, and known as 'amphidizers,' then treated with CaCl_2 solution in a similar 90 ft. cylinder of larger diameter. The solution is then filtered on flat filtering surfaces of silica sponge, which work surprisingly well. The gold and silver go into solution along with the copper and are subsequently precipitated. The only trouble with the process is the elemental objection that, so far, it will not work, the inventor having bitten off more than he can chew in devising unusual forms of apparatus to carry an unusual reaction. By the time it is brought upon an operating basis, if ever, it is possible that some cheaper and more satisfactory method will have been devised.

Nevada has a new silver camp that shows promise of importance. It is at the head of Rochester canyon on the west slope of the Humboldt range and about 20 miles northeast of Lovelock on the main line of the Southern Pacific. That there were veins in this district has been known a dozen years or more and claims have been repeatedly staked and abandoned. Early in December J. F. Nenzel shipped two car loads of ore that returned nearly \$100 per ton. A stampede ensued. Since then a large number of claims have been staked, and a small town built. There are now all the usual features of a mining rush. The find is attracting the serious attention of engineers and investors, but it is too soon to estimate its real importance.

Diamonds have been found in Arkansas for some years and in a recent number of *The Mining Magazine* the question was asked why the Arkansas diamond mine was still neither a productive enterprise nor a deserted property. The principal reasons lie in the scale of operations necessary to prove the ground and the fact that the deposits are in a region where diamond mining is new. With the same amount of evidence before an engineer in South Africa there would be no hesitation as to recommending expenditure of the necessary money. In the United States the matter is more difficult. The principal 'pipe' in Arkansas is roughly a half-mile in diameter. The rock is true kimberlite, and diamonds are present. It is still necessary to determine what may be taken as a safe figure for the average yield per load, and it is also necessary to know the extent and depth of the

weathering. Within the year one small washing-plant was erected and diamond drill-holes were put down to study the weathering of the rocks. The principal property is now under option to a syndicate of men affiliated with the Canadian Mining and Exploration Co. W. W. Men, the consulting engineer, is planning a thorough test of the property. Why development has lagged will be realized when it is stated that in order adequately to sample the pipe, Mr. Men proposes to mine and crush 100,000 tons of rock. This will give a sure basis for future work. If the result of the test is favourable, a successful industry may be safely predicted. Ralph Stokes, of whose competence there can be no question, is in immediate charge of the work.

Alaska enjoyed a good year in 1912 and prospects for 1913 are even better. It is true that the coalfields remain unopened and railroads have not been extended, but the Bureau of Mines is extracting a test lot of coal for the Navy and an able commission has been at work on the transport problem. Gold mining, however, is the main resource at present. At Fairbanks, the development of quartz mining has been extensive. Sixteen small mills are now at work. As yet only small and rich veins have been opened, but with better economic conditions the development of larger mines is expected. The Tanana Valley railroad, it is announced, will be extended next summer from Chatanika up Cleary creek, and plans are under way for much needed power development. In all, 22 lode mines in Alaska were credited with \$4,600,000 out of the total of \$16,650,000 won in 1912. The Treadwell group, naturally, produced the bulk of this, but other mines are in the making. Work on the Perseverance and the Alaska-Juneau audit is proceeding rapidly. Bewick, Moreing & Co. made a careful study of the Auk Bay properties, though with what results has not been announced. The copper production for the year is estimated at 28,940,000 pounds.

As an illustration of operations under difficult conditions, we give a photograph of the concentrating mill of the Kennecott Copper Co., at the Bonanza mine, in the Copper river district, Alaska. The ore is delivered by an aerial tramway three miles long to the mill. This was erected on foundations laid directly on frozen ground, which thawed as soon as the waste water in the mill soaked into it. The mill was endangered; it threatened to slip down the hillside. Therefore a cribbing of timber had to be placed underneath the structure and on bedrock. This may seem like

reckless engineering. At first sight, it appears obvious that the foundations should have been laid on bedrock, even if that entailed a little digging. As a matter of fact in this part of the world the ground is frozen to a depth of several hundred feet, by reason not of a seasonal, but a permanent or Glacial, frost. The mill might have been built on a flat site, with the compensating use of bucket-elevators, but it may be presumed that reasons existed for choosing the old-fashioned side-hill site. Early in January a snow-slide or avalanche smashed

net. This is an increase of 5,000,000 or 6,000,000 bbl. over the output for 1911, but the increase in California was offset by decreases in Oklahoma, Illinois, and the other Eastern states. In general, the petroleum situation is excellent. The demand for light oils has sent up prices in most states. Wyoming attracted special attention during the year, the output increasing from 275,000 to 2,200,000 bbl. The principal gain was in the Salt Creek field, which yields, as it happens, a particularly desirable high-grade oil.



KENNEBEC MILL, BONANZA COPPER MINE.

the compressor-house, killing no one. But three weeks earlier another snow-slide at the Copper Mountain mine, about 20 miles from the Bonanza, carried away the bunk-house and killed 9 men. Such fatalities are not common on the south-east coast of Alaska, where the precipitation of moisture from the Pacific causes big accumulations of snow.

Petroleum production in the United States in 1912 was large but not quite up to that of 1911, according to D. T. Day of the United States Geological Survey. California led with an output of about 90,000,000 bbl. gross, which, making reductions for oil used in the fields, means 86,000,000 to 87,000,000 bbl.

TOKIO.

Korean Coal.—Interesting work in the briquetting of anthracite has recently been undertaken by the Japanese Government, which has constructed a plant for the purpose at Tokuyama, near Shimonoseki. The idea is, of course, to supply smokeless fuel for the Japanese navy, since the steaming coal used by the Japanese merchant marine gives a rather long and smoky flame. It is interesting to note that the coal supply is secured from Korea, where at Ping-Yang, near Chinnampo, the Government has opened mines and is shipping coal at the rate of 100,000 tons per year, all of it going to the plant at Tokuyama.

Thus a large factor in the importance to Japan of the possession of Korea is its usefulness from a strategic standpoint. Japan in its modern development is far from being a self-sustaining country, since it imports a good deal of foodstuffs, and has to import practically all its iron and a number of other important commodities. Thus in the event of war the country might be seriously hampered by inability to secure its customary supplies from abroad, and the Japanese find corresponding room for congratulation that Korea aids materially in remedying this want. Thus the Government iron works at Wakamatsu, which formerly drew its supply of iron ore from China, is now supplied in large part from the mines at Chai-lyong, Anak, and Eunyul, in Korea, where shipments are being made at the rate of 150,000 tons per year through the port at Chinnampo.

The development of a supply of smokeless fuel for naval purposes in China has not been carried to a conclusion, since the Chinese navy has not as yet advanced beyond the embryonic state. Nevertheless a number of individuals in Peking have for some years been endeavouring to finance the development of a field of high-grade anthracite coal, at Chai-t'ang, in the Western hills, not far west of Peking but rather inaccessible, since it is in rough country. The Chinese Government has so many needs and so little funds that it has never taken the matter up seriously, and indeed there seems little necessity for so doing, since in Shansi and the adjoining parts of Chili there is an abundant supply of anthracite coal of excellent quality which can be bought in the open market, without the necessity for the construction and maintenance of a government plant. Coal in China varies from a bituminous (almost a lignite) at Fushun, in Manchuria, through all grades of bituminous to the highest grade of anthracite, and the supply is ample to meet all probable future needs of the country. The development of coal properties has naturally been largely controlled by transportation facilities. Shipping facilities have governed the sale of coal for marine purposes, and though the coal supply of China is both more abundant and varied than that of Japan, nevertheless Japanese coal has furnished the supply for the important ports of southeastern China because the Japanese collieries are nearer to these ports than are the coal mines of China, while the superior shipping facilities of the Japanese producers have enabled them to nearly dominate the market, though the Chinese Engineering & Mining Co., with col-

lieries in North China, and the Australian producers have been able to compete to a certain extent.

Oil-fuel. The variety of fuel available on the borders of the Pacific leads to interesting problems of marine trade. Along the American coast fuel oil offers such advantages that its use is becoming well-nigh universal. But for trade with the Orient or Australasia it is scarcely feasible to use fuel-oil, since either a sufficient supply must be carried for the return trip, or else such a type of boiler and fire-box must be employed that fuel oil can be burned on the outward voyage and coal on the homeward voyage. Both of these plans have been tried, and are even still followed in certain instances, but both offer obvious disadvantages. It is evident that no simple solution of the problem is possible, for there seems little chance of developing a supply of fuel-oil on the Oriental side and even less of developing an abundant supply of cheap good coal on the west coast of North America.

JOHANNESBURG.

Politics and mining exhibit signs of throwing off the close connection that has helped so much to mould the history of South Africa during the past twenty years. Whether that alliance has been for the good of the country or not, future historians must decide. Those who have taken an active part in its development are still too dazzled by the kaleidoscopic changes that have supervened to be able to see things truly and to apportion praise and blame correctly. They all agree, however, that when the last two decades of Transvaal history are handled by a gifted historian the result will be more fascinating than any novel. The most important force tending to bring about a dissociation of interests is at present the change in public opinion, as crystallized in the shape of The Young Unionists' Society; and this is particularly significant as the Unionist party is the stronghold of capitalistic influence. The underlying motive seems to have been born about the time of the East Rand Proprietary fiasco, and to be a distaste of mining-house control in politics. On the top of this revolt or internal dissension comes the decision of the Miners' Association to throw in its lot unreservedly with the Labour party, thus immensely adding to the political array opposed to Unionism. It is difficult to see how far the pendulum will swing, but fears are entertained that the mining industry will not in the next parliament have the presentation to which its superior economic

importance justly entitles it, and that the balance of parties will be such that the Nationalists will have it all their own way, to the detriment of sound impartial government. For these reasons it is to be hoped that the conventional Unionists will sit up and take notice of what popular opinion has said and has to say, and act accordingly; otherwise, after the results of the next election are out, some one may remark, as did Sir William Harcourt about the collapse of the Opposition of his time: "There has been nothing like it since the days of Sennacherib."

port prove as big an eye-opener as Mr. Ross Browne's did? The chairman's reference to the elaboration of the small stope-drill is timely in view of the present, and ever present, labour shortage, and the slow progress being made by manufacturers and users in developing the small stope-drill is greatly to be deplored. It is to be hoped that the Gold Fields will furnish Rhodesia with some good object lessons in how to finance, develop, and run a gold mine; the country badly needs them. The chairman's remarks about West Africa indicate that he does not think much of the mines



NATIVES FOR THE RAND GOING ABOARD AT MOZAMBIQUE.

The Gold Fields meeting interested the Rand by reason of the utterances of its genial chairman, Lord Harris. His expression of shame at having perpetually to base an excuse on the difficulty of native labour has struck an answering chord in many another chairman's heart, but the blushes are still hidden—in annual reports. That beautiful euphemism 'selective mining' came into its vulgar metaphorical own, and having discarded its masquerade stood revealed as the old and truthful phrase, "picking the eyes out of a mine." Regarding this special method, Mr. H. H. Webb is to report on the advisability or otherwise of its adoption at the Simmer Deep. There are possibilities of wide variation from standard practice here. Will Mr. Webb's re-

of that country. Neither does anyone else. His opinion that oil is easier to find than to sell should be noted. Who knows but what an oil boom will some day emanate from a wild and woolly dorp in the backveld, and it may really be oil too! The statement that "they were quite willing to make fresh ventures in the Transvaal, but they wanted to see their way more clearly than they did at present" sounds ominous. Is mining in the Transvaal played out as far as investors are concerned? All these little points in the speech make interesting reading, coming, as they do, from such a well informed and authoritative source.

Rhodesia, in Rand eyes, is no longer the land of promise but the land of disappoint-

ment. The Johannesburg mining houses, with few exceptions, will now have none of it at any price; and this is not to be wondered at when the meagre harvest resulting from the strenuous planting of capital during the concluding months of 1909 and the early ones of 1910 is quietly considered in a sane and un-speculative atmosphere. At that bright time affluent mining engineers kept motors chugging alongside the sidewalk near their office-doors, and cheque-books in their pockets and themselves in readiness to dash off and acquire an option over the newest pot-hole. The result of this insane optimism is a sane pessimism. It is now recognized that the plums are few and far between, and that they take an immensity of finding. The opinion seems to be general that Rhodesia is a much over-rated country from every point of view, except perhaps from Danger Point at the Victoria Falls, and that there is little there worth making the journey up for. There is no doubt that at present mining affairs are in anything but a prosperous condition. The intense drought, only broken on January 7, compelled many mines to shut-down; it also proved a serious obstacle to prospecting as well as to farming. The prevailing depression has driven numbers of men out of the country, and has reduced hundreds of others to an acutely hard-up condition. So severely is the absence of ready cash being felt at Salisbury that the Administrator has asked the Mashonaland Farmers' Association if there is any chance of these stranded men obtaining work on the farms in return for their board and quarters. It is in times of gloom like this, however, that the shrewd speculator often acquires interests that return him a handsome profit later on. The small capitalist on the look-out for a profitable small mine should be able to pick up something useful when buyers are so scarce. But anyone trying his luck there must understand his business and know Rhodesia if he hopes to be successful.

Witwatersrand Deep.—The tapping of the 'water dike' toward the end of 1911 and the enormous flow therefrom into the workings, has knocked this company sideways for the present. In 1910 the dividend was 50%; in 1911, 35%; and in 1912, only 25%. The tonnage crushed decreased during 1912, as also the yield and profit per ton, while the cost rose owing to the expense of pumping and the check to the normal course of underground operations. The working profit for 1912 was £205,000, or some £97,000 less than the working profit for 1911. During the first

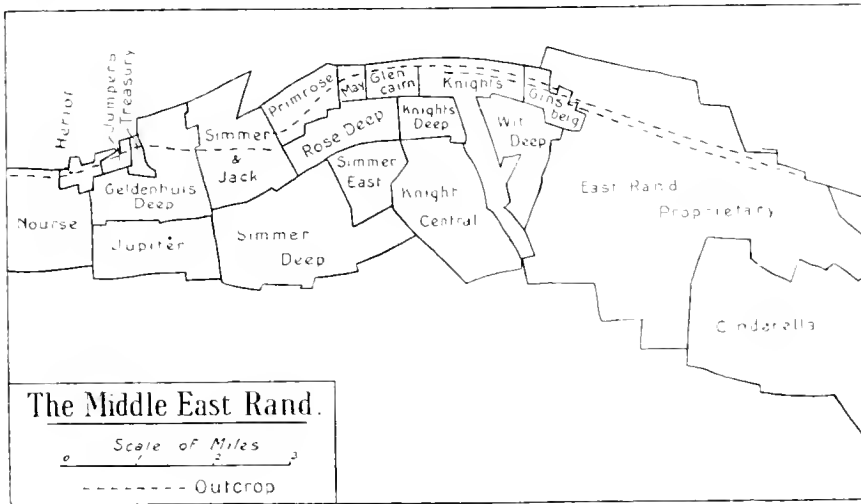
quarter of 1912 the working cost was 19s. 4d., yield 27s. 1d., profit per ton 7s. 9d., total profit £43,623, and gallons pumped 176½ millions. In the last quarter of the year the corresponding figures were approximately: 17s. 10d., 27s. 7d., 9s. 9d., £55,135, and 170 millions. It is evident therefore that an improvement is well on the way, and the results for 1913 should fully reflect this. Owing to the inflow of water on the lower levels in the central section of the mine, development was greatly hampered, with the result that the ore reserve decreased. This decrease was, however, balanced by an increase in the value of the ore developed, the bottom levels in the central section having exposed ore of good value. At the end of 1911 the profitable ore reserve was 1,436,202 stoping tons of an average assay-value of 6.79 dwt., and at September 30, 1912, it was approximately 1,332,343 stoping tons at 6.92 dwt. per ton. The position in this respect is thus one not calling for any alarming forecast, and as soon as the water is fully under control on the lowest levels the ore reserve will no doubt be rapidly increased. In connection with this water question it is expected that the East Rand Proprietary will encounter this 'water dike' in its Driefontein section in the immediate future, and that it will drain the water into its workings and thus relieve the Witwatersrand Deep, just as the latter has relieved the Knights Deep. The company draws about 70% of the tonnage necessary to feed the mill from its profitable ore reserve, the remainder coming from blocks previously considered unprofitable, excess stoping-widths, development headings, and reclamation work. It is practically a 'one-reef' mine, and having a steep dip, about 50°, it lends itself admirably to sand-filling. By means of this filling the recovery of large quantities of valuable ore left in the old upper workings is rendered a comparatively simple and cheap process, and in consequence of this the value of the ore going to the mill is increased in return for a slight outlay.

Jupiter.—A mine named after the Roman god who determined the course of all human affairs, must always command a tinge of respect apart from the romance attaching to the fact of its being the second deepest gold mine in Africa. When, therefore, the company declared a dividend of 2½% in June on its issued capital of £1,014,200, followed by the same declaration in December, making a total of 5% for the year, congratulations were many, not alone from shareholders to themselves, but

also from those who, though not immediately concerned, have the welfare of the industry at heart. The only previous dividend was one of 5% in 1909. The improvement has been brought about by an increase in the tonnage crushed, from 314,650 tons in 1911 to 476,450 tons in 1912, and a decrease in capital expenditure; and although the value of the ore milled fell about $\frac{1}{2}$ dwt. the reduction in working cost more than counterbalanced the decrease, with the result that the working profit for 1912 was £65,830, a marked advance on the £31,952 working profit of 1911. As a sign of the good progress the company is making, the working profits for the quarters of 1912 may be noted. These were, respectively, £12,368, £14,655, £17,254, and

amount. It is to the perfecting and to the extending use of the small machine-drill in stoping that the Rand must look for the solution of its native labour problem, and this group is to be congratulated on its efforts in that direction.

Knight Central.—No dividend was declared in 1911, as the directors considered it essential to maintain a large cash balance in view of the disappointing nature of development. The dividend was again passed in 1912 owing largely to a continuance of poor development results, but chiefly to the uncertainty introduced by a dike disturbance, which has caused a severe up-throw to the south of the present workings. The future of the mine depends on the value of the ore south of this



£21,553, pointing to an increasing and steady gain in the financial results achieved. The company is now milling on a scale approaching its full capacity, and there does not appear to be any reason to apprehend a reduction in the scale of operations. The working cost now averages about 17s. 3d., which, all things considered, it is a very reasonable figure indeed for a 'deeper deep.' In accordance with the practice of the Gold Fields group, considerable attention has been paid to the introduction of machine-drills as a substitute for hammer-boys. Most engineers aver that increased employment of machines means bigger stoping-widths, but the experience of this company in 1911 throws some doubt on that opinion. In that year the percentage of ore stoped by machines increased to 66, or 22% more than in 1910, and yet the average stoping-width rose only $1\frac{1}{4}$ inches—a negligible

dike, and no reliable data will be forthcoming until driving on the reef starts from the crosscuts in the second quarter of the present year. A bore-hole put through the dike to ascertain the amount of the dislocation and the value of the ore at that particular point, showed that the Main Reef had a value of 2'0 dwt. over a width of 60 inches, and the South Reef a value of 4'5 dwt. over 46 inches. This result indicates poverty, but bore-holes are reliable only as pilots to 'reef-horizons' and not as guides to gold contents.

During the year 1911 the important figures reflecting the progress of operations were: cost per ton milled, 18s. 9d.; yield, 23s. 3d.; profit, 4s. 6d.; and total profit, £70,817. Only 40% of the development was profitable, having an average stoping-value of 8'16 dwt. During 1912 the cost per ton milled rose about 9d., the profit per ton fell practically the same

amount, as the yield remained almost the same; the tonnage crushed decreased by 28,571 tons, and the total profit fell to £54,427. During the first nine months of 1912, slightly improved results were obtained from development, but the improvement was not sufficiently marked to alter the position. At the end of 1911 the profitable stoping-reserve was 644,300 tons, having an average value of 6'0 dwt., and at September 30, 1912, the tonnage was 653,600, having an average stoping value of 6'11 dwt. The financial position should now be strong, as the credit balance of the appropriation account amounted to £105,444 at the end of 1911: so that the chief controlling factor as regards the future will be the value of the ore found south of the dike.

MELBOURNE.

Politics.—Though it is not usual in a publication devoted to a special industry to touch upon general politics, still when the course of the latter affects all industry it is obvious that no subject can be of greater importance. When the Commonwealth of Australia was constituted, certain sovereign rights were retained to the States forming the federation. The reason for this may have been a doubt as to how the Federal Parliament would fulfil the responsibilities entrusted to it. But there also was latent the fear that if full powers of legislation were conferred on the central executive over so vast a territory as Australia, and one having such variations in natural conditions, the development of the States would be retarded. There can be little question that this fear was based on solid foundation. Queensland, for instance, because of the 'White Australia' cry, has had to deprive herself of the Kanaka labour necessary to enable it without State aid to keep its sugar plantations as a home industry. At first the Labour party was non-federal. Now its members are Federal unificationists: they wish to blot out the States and centralize the government in the eastern division of the continent. The objective, of course, is to give effect to their socialist programme, including the nationalization of the sources of wealth. In most instances they propose to attack existing institutions by the use of Federal capital and Federal legislative power. This has been done with the banks, which have first of all been deprived of their note issues, and then have in the field as a competitor an ordinary trading State bank, which is fighting for business against the existing private establishments. They have supported the starting of a State

coal mine, of brick-works, clothing factories, docks, workshops, and other utilities, besides which, they are promoting extensive venturing in railway construction. On top of it all they have established a so-called Conciliation and Arbitration Court, in which a sympathetic judge sits not only to interpret laws but to make legislation. His aim and that of the cohorts of the Labour party is to suspend the operation of the law of supply and demand. Regardless of economic laws, he deals out high wages, and gives preference to unionists, all the while implying that those who, from the instinct of self-preservation, may have to resist him or may seek to evade his jurisdiction, are oppressors of the masses. True, he is not Jeffreys-like in his language, but his innuendoes, his open advocacy of the interests of one class, and his resentment at the dominance of the High Court as a Court of Appeal, are appalling to those who expect to see in any court of high jurisdiction the suppression of personal predilections and of class likings. Today it can be said that the nature of the judgments delivered in the Arbitration Court is such as to stimulate the working classes to declare that their case must go before Justice Higgins, and to compel the employing class to dread such a reference. In the New South Wales legislature one member has uttered public protest, and last week in the Federal Parliament another member took exception to Justice Higgins because he was an advocate, not a judge. With men of his type, men who are politicians more than judges (for there is another man of the same type on the bench), the determination of the Labour party to ask the country by referendum to enlarge the powers of the Federal Parliament, so that it may control the industry farther by relieving the States of all real control over labour disputes and conditions, and by empowering it to legislate entirely in respect of companies and corporations, is a matter of the utmost importance to the man who has capital invested in Australia.

Silver Find.—The news is being circulated that a rich silver-lead discovery has been made at a little place called Cowell, near Port Lincoln, in South Australia. The district lies close to the water, but in an arid and hilly tract. Some rich chloride has been found, which has assayed up to 7000 oz. silver per ton. While this is so, the discovery has to be viewed with a good deal of dubiety. The locality has been well prospected before, owing to the finding of small deposits of copper ore. These, however, have proved to be stringers

of the most tantalizing description. One of the government geologists has visited the finding, and his report is not very illuminating, for about all that it tells is that certainly there is some rich ore, but that so far only limited surface prospecting has been done. The vein, so far as developed, appears to be narrow. Of course, the high assays induced a rush to the locality, but the investor is not in a frame of mind just now to join in any mining flutter. The Bullfinch boom froze his enthusiasm.

Broken Hill.—One of the questions that has faced the managements of the Broken Hill mines is that of introducing a fresh leaven of labour into the Barrier district. With a

for many concerned. Some of the companies long since realized the need for introducing fresh supplies of labour. They, however, have had to walk as discreetly as was done in Western Australia. Still there can be little question that recruiting is going on outside Australia, as the past year has seen a decided increase in the 'foreign' (that is, British) labour. There has been a good deal of unrest over the influx, and if at any time employment on the Barrier should slacken, there will be trouble. What weakens the position of the companies there is the isolation of the Broken Hill Proprietary Company. This isolation was at one time intentional. When



BLOCKING ESCORT DURING THE STRIKE IN 1910.

Labour government in power and with the representative of Broken Hill in office, the task would appear to be well nigh hopeless. It is the policy of the country to obtain more inhabitants, but it is equally the policy of the Labour party, despite all their mouthing on the subject, to keep out any new comers who are likely to act as competitors with the masses in the lower walks of life. At present expert miners at the Barrier earn with comparative ease from £4 to £6 per week of six shifts of 8 hours per week. This is on contract work, and so long as the price of lead keeps up no one worries at the pay because of the profits that are being earned. With any relapse in the metal market there would be the deuce to pay; for the present rate of dividend would then be impossible, and the loss of capital to the investor through the shrinkage in the market-price of scrip might end unpleasantly

secured, it was discovered that an element of danger was introduced, for if there be not accord amongst employers, no united front can be presented to the worker, whenever he may demand a larger slice of the profits. Certainly the risk just now is that the worker at the Barrier will want a bigger cut into the profits than heretofore. Seeing that the bulk of the shares in Broken Hill companies are held outside Australia, very few on this side of the world would be inclined to resent such a demand. That is just where the danger comes to the man over the water.

Iron Industry.—No fresh news has appeared in respect of the intentions of the directors of the Broken Hill Proprietary Company regarding their iron and steel manufacturing venture. The future career of that enterprise, however, is being most widely discussed, and it is the belief of the people in the possibilities

of the enterprise that keeps the company's shares standing where they are. What has hindered any forward movement by the company, so far, has been the need, first of all, of securing parliamentary sanction to certain concessions in respect to land and water rights at Newcastle, where the smelting works are to be established. It was feared that the Labour government, with its nationalization ideas, might block the enterprise. That might have been done had the State found it easy to raise capital. But with the money-market tight, and the Government based on a majority of one, there was not much chance for the Ministry to satisfy its ambition to become an iron-master. Last of all, the Proprietary company had to obtain the assent of the Supreme Court to certain alterations in its memorandum of association. All these details have been attended to, and the board now has only to raise the capital necessary to finance the proposed undertaking. The high price of metals has put a considerable sum in the possession of the directors, so that they are under no obligation to wait until they test the London market, but it seems to be pretty clear now that what the board will do, as it has waited so long, will be to try an issue of debentures with the right to subscribers to convert such debentures into shares within a given period. Some time must elapse before the works are in operation, but those who are at present interested in the company, or who may in the future decide to assist it in its new enterprise, can be assured that they will have the very best possible run for their money. The directors of the company have all been connected with the Proprietary's enterprises for many years, and there has never been a whisper against their integrity or a suggestion that they have used their position for market purposes. In this respect they differ materially from many other Broken Hill directors, who plainly do not appreciate that line of conduct, although the public does.

Coal mining in Victoria, from the standpoint of the private investor, has been a thing of shreds and patches. The coal is good and commands a ready market, especially as a household fuel. But for twenty years one company after another has had to admit an unsatisfactory state of affairs. This has arisen from the heavy costs due to faulting of the seams, which have been so tossed about, zig-zag fashion, that a tremendous amount of dead work is inevitable. The companies would have rehabilitated their fortunes, as the methods of finance were good, had they

been given a chance to go to the Powlett basin when coal was found there. Unfortunately Mr. McBride, the State Minister of Mines, simply suppressed private enterprise in that locality, and so the outlook for companies is doubtful. Not only have they to overcome physical difficulties, but they have to face the competition of the State mine, into which money has been poured with a lavishness typical of public management. Profits are almost things of the past, and it has been suggested in the case of the Outtrim-Howitt company, in which a good deal of British capital has been invested, that it shall shut-down. This certainly would be a mistake, for if the present Minister of Mines wanted to go out of office the chance would be given to private enterprise to open up some part of the Powlett coal basin.

KALGOORLIE.

The Great Victoria, at Nevoria, now being prospected by Mr. Richard Hamilton on behalf of the Great Boulder company, has produced £1360 from 2500 tons by amalgamation during the last mill-run. The residue assays 19s. 6d. per ton, making the gross value of the ore 30s. per ton. Mr. Hamilton is sinking a new prospecting shaft, which has been equipped with headgear, winding-winch, boiler, etc., and is apparently determined to test the mine as far as practicable during the currency of his option. The owners, Messrs. MacDonell and Delbidge, are allowed to mine and treat ore during the option, but were obliged to stop when the dam ran dry. However, some heavy showers have recently fallen, and crushing has been resumed. The original price put on the property was £50,000 cash, and one-eighth interest in shares, but, as there might be some difficulty in securing the shares, the terms have been modified and £100,000 cash named as full payment.

Bullfinch.—The plant on the Bullfinch Proprietary is practically complete, and crushing is expected to start shortly. According to the management, 6000 tons will be treated monthly for a profit of £10,000 to £12,000. The main orebody, on which the mine was floated, cannot be found at the 310-ft. level, but the northern series has been picked up 450 ft. north from the shaft, and the southern series 400 ft. south. These lodes are quite vertical, which means that an enormous amount of cross-cutting and trucking will have to be done to open-up each level, and this will add materially to the ultimate cost. Prospecting is to be pushed ahead when the mill is at work.

The Corinthian North, situated half-way between Bullfinch and Southern Cross, is being equipped with a 20-head mill, and all accessories, and is expected to start production in April. The lode on the property is up to 36 ft. wide, and has been proved on the 100-ft. level for a length of 870 ft. The average width is 16 ft., averaging 28s. per ton. A winze, sunk 18 ft. below the 100-ft. level, is in sulphide ore assaying 64s. per ton. The ore assured is estimated at 158,600 tons assaying 24s. 8d. per ton. The property consists of 156 acres, and it was originally intended to float it in London, but the collapse of the Bullfinch boom put an end to that idea, and it was transferred to Adelaide. There are 200,000 shares of 10s. each in the company, of which 180,000 are issued.

The Edna May at Weston's, 35 miles west of Southern Cross, is another mine of big possibilities that owes its discovery to the Bullfinch boom. At a depth of 70 ft. the quartz lode on this property has been followed for a distance of 200 ft., the width of the drift being 10 ft. The average assay-value of the ore is 30 dwt. per ton. The original owners, Messrs. Anear & Williams, mined and treated 572 tons for 969 oz., worth £3610, or 126s. 2d. per ton by amalgamation only, and then sold the property to a Melbourne company. The capital is 50,000 shares of 10s. each. Since the company took over the property, in October, 600 tons have been raised, and are now being treated at the Greenfinch mill, and a return of at least £6 per ton is anticipated. As a surface proposition this mine is one of the best ever discovered in the State, but it has yet to be proved whether the lode lives down. The Greenfinch itself has produced £3910 from 1320 tons by amalgamation alone, and there remain 850 tons of residue assaying 14s. per ton. Other mines that owe their discovery to the Bullfinch boom are the Mountain Queen, Great Unknown, Comet, Eclipse, and May Queen. These are only a few of the many mines discovered within the last two years by genuine prospectors. Most of the areas pegged out near the Bullfinch, as also at the recent rush to Kurnalpi, were held by bank-clerks, shop-men, and barmen, who did no prospecting, but merely held the leases for speculative purposes so long as there remained a hope of selling them.

Labour.—William Martin, manager of the Victorious, at Ora Banda, says that the difficulty with the filter-presses has been overcome, but he has been met with a still greater difficulty, namely, a shortage of miners to keep

the mill going. This difficulty is experienced all over the State, and this would have been emphasized long ago had it not been for the influx of Italians and Austrians, who are anathema to the present Labour government. In fact, the Premier has openly accused the Chamber of Mines of blacklisting Britishers for expressing their political opinions and favouring foreigners. The Chamber has replied denying the soft impeachment, and pointing out, if the accusation were correct, they would employ no Britishers at all. Nearly every mine in the State is, at present, short-handed, and this state of things is likely to continue, especially with the big mines, as numbers of men strongly object to work at depths of 2000 ft. and more. Only big pay will tempt them.

CAMBORNE.

Falmouth Consolidated.—The belated report and accounts of this company for the fifteen months ended June 30, 1912, have now been issued. The expenditure during this period appears to have been as under :

Mine equipment	£15,993	
„ development.....	2,171	
General expenditure at mine.....	£28,616	
Less receipts, sales of tin, etc.....	18,701	
	—————	9,915
Expenditure in London less transfer fees.....		7,321
		—————
		£35,400

The issued share capital of the company is £119,683, bonds to the value of £58,900 have been issued, while loans and creditors figure at £33,129. The property is an extensive one, consisting of the Wheal Jane, West Jane, Nangiles and other old mines in the parish of Kea, while the plant is probably one of the largest in the West of England. The mill consists of 60 Californian stamps, the last 20 of which were put into commission in January.

The report of the new manager (A. R. Shutes) covers the period from April 1, 1911, to January 3, 1913, while the accounts as stated are made up only to June 30, 1912. It is therefore impossible, particularly as no profit and loss has been prepared, to figure out the working cost, but the manager puts it at 15s. 6d. per ton, exclusive of London expenses and certain other unnamed disbursements. It appears that owing to financial circumstances, development work has been restricted, the

total for the 21 months being only 1800 feet, so that although the increased tonnage to be handled in future should result in a reduction, adequate development will probably more than offset this. With the bond interest and London expenses added (on the basis of the accounts under review over 2s. 6d. per ton), and allowing nothing for depreciation, it seems that the directors are sanguine in anticipating a cost of 15s. per ton. Under the supervision of H. W. Fox (of Sir Douglas Fox and Partners) the whole business has been thoroughly reorganized. If the present price of tin is maintained, there is a prospect of the company becoming a fair-sized producer, and more than paying its way even on present grade stuff and a recovery of 18 lb. per ton. With vigorous development, the grade will probably be improved; in the meantime the manager anticipates no difficulty in supplying the 60-stamp mill with ore for the next twelve months. This estimate is not so grandiloquent as that enunciated by the Chairman two years ago, when he said that there was ore sufficient to feed a thousand stamps. For the four weeks ended January 17 last, 3535 tons of ore was crushed, producing 28½ tons of black tin, realizing £4084, which proves how effectively the company's new roasting plant is dealing with the highly pyritic tin concentrate.

Mulberry Mine.—Under the supervision of Bainbridge, Seymour & Co., the work of erecting the new 30-stamp mill and crusher house with sorting floor is making fair progress, and it is anticipated that operations will start in March next. This property is a low-grade stockwork situated in Lanivet, Bodmin, and various attempts have been made in the past, without success, to handle the stuff profitably. It is hoped by close sorting to raise the grade considerably.

Wheal Kitty and Penhalls.—This company reports a profit of £472 for the six months ended December 31 last, which on the tonnage milled is only slightly over 1s. 2d. per ton. This is not a satisfactory result, considering the high price ruling for black tin. The company has been unfortunate in striking a belt of disordered ground around the new main shaft (Sara's). The width of this belt increases with depth. This disturbed country is due to the presence of the main cross-course, which between the 510 and 720-ft. levels splits into several branches. After spending over £12,000 on sinking and equipping this shaft, it is disappointing to find that the shaft has been put down in such a poor and disturbed zone. During the six months, 7885 tons of

ore was milled, which produced 78 tons of black tin, or a recovery of 22½ lb. per ton. This black tin sold for £10,368, or nearly £133 per ton. The development footage was 1175 feet, or 1 foot to each 6·7 tons stopped. The working costs were as under:—

	s.	d.
Mining	9	3·25
Development.....	4	2·29
Pumping.....	1	8·56
Dressing.....	5	5·15
Repairs and Maintenance.....	1	7·02
General Administration, Taxes and Insurance	1	10·53
	24	0·80
Royalties	1	3·00
	25	3·80

This cost appears high in view of the shallow depth of the workings and the light pumping charges, but it must be borne in mind that the lodes are narrow and much faulted. The company has done well in the past, having made profits of £17,000 on a subscribed capital of slightly over £22,000. The district is notoriously lumpy, so there is no reason, with adequate development, why richer ore-shoots should not be intersected in the future.

Treburland Wolfram & Tin Company.—Under the chairmanship of W. J. Barnett, this company has been formed with a nominal capital of £50,000, to acquire and work the Burland tin and wolfram property of 95 acres in the parish of Altarnun, 9½ miles from Launceston. The property was worked on a small scale as an open quarry about 10 years ago under the name of Wheal Annie. The engineers who have examined the property recently report that the reserves may be estimated at 50,000 tons above the 100-ft. level, averaging 1% of tin oxide and 3% wolfram, but this tonnage is much 'in the air' and is not blocked-out in any way. The figures are obtained on the assumption that the lodes will continue productive in depth. It is proposed to spend £8000 on plant and development, and in nine months it is anticipated that the mill will be ready to deal with 50 tons per day, the average extraction being 20 lb. black tin per ton, and 3% wolfram. The working and administration costs are put at 20s. per ton. The purchase consideration was £23,000, of which £3000 was payable in cash; £15,000 was underwritten at 7½% cash commission, so unless the whole of the capital was subscribed, the margin for contingencies is small.

TORONTO.

Porcupine.—Production and development work in this district are still greatly hampered by the continuance of the miners' strike, which shows no signs of coming to an end. At one time it was supposed to be practically terminated, so far as the operators are concerned, by the importation of large numbers of strike-breakers, and it was stated that the leading companies had no difficulty in obtaining all the men they wanted. As regards mere numbers, this was no doubt correct, but the great majority of the new-comers being inexperienced in mining, the companies that are still operating have had lots of trouble. An official statement from the Hollinger shows that

Lake mine is now the deepest in the camp, having reached the 600-ft. level, where cross-cutting has been begun to reach the vein found on the 400-ft. level. The shaft will be continued down to 800 ft. The Rea mine is being unwatered, having been leased for five years to John Reddington, who has agreed to erect a 25-ton mill and pay a 25% royalty on net profits. A company is being organized to operate under the lease. The Crown Chartered, with an authorized capital of \$2,000,000, of which \$1,751,666 was subscribed, has been in financial difficulties for some time, and has gone into liquidation. The Dome Extension has been closed-down on account of the strike. Some rich pockets of ore had been encountered



THE MAIN STREET OF PORCUPINE.

for the last six months of 1912 gold was produced to the value of \$933,973 from 43,227 tons of ore, the percentage of recovery being 96.3% and the estimated profit for the period \$750,000. Since the outbreak of the strike, the mill has not been operating to full capacity, merely crushing enough ore to enable the company to meet dividend requirements. No figures as to the recent output of the Dome are available, but it is understood that the mill is running satisfactorily, making an extraction of 98%, and that at the 60-ft. and 100-ft. levels an eight years' supply of ore has been blocked out. An additional tube-mill and slime-press are being added, raising the capacity of the mill to 460 tons per day. At the Hughes the small test-mill began operations in December and has been treating high-grade ore taken from the 150-ft. level. The shaft of the Pearl

before the shut-down. It is proposed to build a cyanide mill on the Jupiter property early in April. Development work has been started on the Sherrill claim in Tisdale township. Joseph Houston, formerly manager of the Right of Way, at Cobalt, has been appointed superintendent of the Schumacher.

Cobalt.—There has been a marked revival of interest in silver mining lately, and while Porcupine stocks have been quiet and depressed, the Cobalt issues have been active with a general upward tendency in prices. Last year established a new high record for Cobalt, although the silver output showed a decline in volume, being estimated at 30,500,000 oz., as compared with 31,500,000 in 1911, but this was more than compensated by the increase in the price of silver. The estimated value of the output, based on the Government

figures for the first nine months of the year, and the best estimates possible for the balance, is \$17,500,000, as compared with \$15,949,019 for 1911. The total return in dividends paid by 13 companies was \$9,722,850, as compared with \$8,395,558 for the previous year. The latest addition to the list of dividend-payers is the Seneca Superior, which has shipped nearly a quarter of a million dollars worth of ore from the vein discovered under Cart lake, and has declared its first dividend of 10%, calling for a distribution of about \$45,000. The annual report of the Coniagas showed net profits for the year ending October 31 amounting to \$1,701,553, the balance in hand being \$1,278,988. The silver shipments were 3,508,377 oz., the cost of mining and concentrating being \$51 c. per oz. The ore reserves were estimated to contain 17,441,800 oz. silver. During December the Nipissing mined ore to the value of \$460,052 net, and shipped ore to the net value of \$261,396. The Meyer vein alone yielded 440,000 oz. The high-grade mill treated 164 tons of ore, and shipped 422,495 oz. of bullion. The balance on hand at the end of the year was \$1,470,918. The total income of the La Rose for the year 1912 was \$1,796,880, and its operating expense \$779,916, leaving a net profit of \$1,026,663. The cash surplus on hand at the end of the year was \$1,667,104, and the total surplus, including shipments and ore in hand, \$1,866,631.

The Northern Customs Concentrator has installed ten more stamps, making the total number 120. About 400 tons of ore are being treated daily. The King Edward is being worked on lease by the York-Ontario Silver Mines Ltd. A new 3-in. high-grade vein has been struck, parallel to the old vein formerly so productive. The Foster, another property that at one time had a leading position, is to be re-opened. It has been leased to a syndicate, which is sinking a new shaft. The Temiskaming has struck a high-grade vein about 3-in. wide in the diabase formation 40-ft. below the Keewatin. The annual statement of this company for 1912 shows that total receipts were \$776,075, and net profits \$413,615. The shareholders of the Cobalt Lake are generally accepting the proposition of the Rose-Van Cutsem syndicate of London to give options on their shares on a basis that will give them a return of 73 c. per share if the option is taken up. It is stated that options have been given on approximately 2,000,000 shares, which is considerably more than the members of the syndicate require to give them a controlling interest.

NEW YORK.

The copper situation, with the decline in the price of the metal, which was finally made necessary because of the accumulation of surplus stocks, has been the predominant centre of interest in the metal world during the past month, as well as one of the main negative factors against expansion in the financial markets. Toward the close of 1912, and during the holiday period, trading in this metal had become very limited and conditions began to show such signs of unsettlement that buying to any extent was completely discouraged. The Copper Producers' report, issued in the early part of the month, showed an increase of 19,000,000 lb. in domestic stocks for December. For a brief time, after the issuance of this report, the concerted efforts of the principal producers held the price of the metal up to its high figure of 17 $\frac{3}{4}$ cents, but it was generally realized that this was only a temporary level, and the market was watched with much interest to see through what channel the fall in prices would occur. Phelps, Dodge & Company, who were holding out with the Amalgamated and the American Smelting & Refining companies for the 17 $\frac{3}{4}$ cents market, were the first reported to break away, and accepted February orders in the foreign markets at fractional concessions from the high figure. The acceptance of orders at lower figures at once became general and sales of considerable volume are now being made at 16 to 16 $\frac{1}{2}$ cents. It is undeniable that Europe was a large buyer for export for the next two months, but the recent unfavourable turn in foreign politics will probably restrain any considerable increase in orders from abroad. General business in this country, though of large volume, as previously reported, appears to be moving on a conservative basis. The recent speeches of President-elect Wilson, in which occurred frank criticisms of many phases of our business and financial systems, portending the attitude of the next administration toward business, have not increased optimism and buoyancy in the industrial world. On this account the feeling of uncertainty in the case of the copper market has been intensified; and the course of developments in the near future will be awaited with unusual interest. In regard to the future level of prices, it must be remembered that there have been no recent discoveries of copper large enough to have any effect on the world's supply. Further, increased production to meet the larger consumption is not materializing as rapidly as was anticipated. The 'porphyries' are really only

filling the void left by the old mines such as Quincy, Calumet and Hecla, and Wolverine. The porphyries increased their output by 68,390,000 lb. of which 27,740,000 lb. was contributed by Chino, this figure being 4,000,000 lb. under the output estimated a year ago. In the case of Miami, where a 30,000,000 lb. increase was looked for, the output for last year only reached 17,844,000 lb.; and Ray was able to increase its production only about one-half of the predicted amount of 42,000,000 lb. I venture to predict that as long as the demand for the metal continues to increase, as it has steadily for the past 20 years, a minimum average price of 15½ cents may safely be counted upon for the next few years at any rate.

The Granby Consolidated, during the year 1912, has smelted approximately 1,263,000 tons of ore, making 22,650,000 lb. of blister copper, extracting 356,376 oz. silver, and 53,359 oz. gold, netting approximately \$1,600,000. This company expects to renew dividends at once, in view of the fact that they have decided to finance further development and equipment of the Hidden Creek property, by an issue of \$5,000,000 convertible bonds, of which \$1,500,000 will be offered to the stockholders; the bonds will be redeemed after 10 years at 105, and such provision will be made that 4% retire annually either by purchase in the market at not more than 110 or at redemption by lot at that figure. Contracts for equipment and for a 2000-ton smelter at the Hidden Creek mine, on the coast of British Columbia, have been closed recently, and final estimates indicate that the cost of the property and development down to the date of commencing the shipments will amount to \$2,944,554.

The Nevada Consolidated finds itself with hard freezing weather coming on and with an insufficient supply of ore stripped and ready for loading. As a result, two sections of the Steptoe concentrator at McGill have been closed-down. This condition has resulted from the labour strikes, which occurred earlier in the season.

Montana.—A report in general circulation is to the effect that E. P. Mathewson, general manager of the Anaconda Company's smelter and the International Smelting & Refining Co., at Tooele, Utah, has resigned and that his successor is to be Walter Wraith, who has been Mr. Mathewson's assistant for several years. It is further stated that Mr. Mathewson is to take over the managership of what are known as the Ryan interests. Some interesting figures concerning the Anaconda Company show

that for the year 1912 it paid to its 13,900 employees an average wage of \$1200, probably a higher rate than is paid by any other large corporation in the United States.

The Butte & Superior concentrator has been treating on an average of from 700 to 800 tons per day. The concentrates shipped to the smelters at Oklahoma are said to be averaging between 47 and 50% zinc. Only one section of the mill is being used; the second section is to be put in operation within the next two months. D. C. Jackling reports that the problem of treating highly refractory zinc ores has been solved, and that results now being obtained at Butte are thoroughly satisfactory.

Low-Grade Gold Mines.—During the month of November the Alaska Treadwell treated, in its two mills, 74,816 tons. The total average expenses were \$75,011, which shows a cost of almost exactly \$1 per ton. It is believed that the Alaska Gold Mines Co., whose property is now in process of rapid development, will be able to improve upon even this cost figure on account of more favourable physical conditions. The organization of this company has now been perfected, and the following officers have been elected: Charles Hayden, president; D. C. Jackling, vice-president and general manager. Directors include the two officials mentioned and the following: C. M. MacNeill, Sherwood Aldrich, Albert F. Holden, William H. Coolidge, Edward A. Clark, and T. J. Gilbert. These men are prominently identified with other large mining companies in this country; Mr. MacNeill being president of the Utah Copper, Mr. Aldrich being president of the Ray and on the board of the Chino and Utah companies, and Mr. Holden being an official of the United States Smelting, Mining & Refining Co. Another low-grade property, the Homestake, South Dakota, has recently declared a stock dividend of 15%, besides increasing its monthly dividend from 50 to 65 cents per share. This is a company which, after paying dividends regularly for the last 33 years, is able not only to declare a stock dividend out of accumulated earnings, but also to increase its regular rate. For stability this record compares favourably with that of any industrial enterprise.

The Breitung Mines Corporation has retained F. Lynwood Garrison to take charge of its dredging properties on the Nechi and Cauca rivers in Colombia, South America. Mr. Garrison and four assistants will leave for Colombia during the early part of February. It is understood that the property will be thoroughly and completely surveyed.

MEXICO.

Persistent Disorder.—After fourteen months of President Madero's rule, Mexico appears to be farther than ever from a solution of its difficulties. Although damage to property owned by foreigners is comparatively small, and the larger mining centres, such as El Oro and Pachuca, have only been troubled with the lesser evils resulting from the revolution in the form of labour difficulties, the general feeling of insecurity is putting a stop to mining enterprise in many parts of the republic. Brigandage is at its worst on the line of the Central railway, from Zacatecas to the border, and in the states of Guerrero, Morelos, and Mexico. Gruesome tales are brought to the capital by mining men who have been unfortunate enough to meet the wandering bands. Even allowing for the rule that allows a narrator to leave a tale better than he found it, there is no doubt that the unsettled districts can only be traversed at great risk. The difficulty of dealing with the bandits is chiefly due to the fact that they can disband and scatter to their villages on the approach of troops, and assemble again when the danger of an encounter has passed. Newspapers refer to 'Zapatistas,' 'Salgadistas,' etc., as if they were organized bands under the leadership of some Napoleon of brigandage, but it is inconceivable that the vermin forming these bands would remain faithful to any leader for long. A 'Zapatista' now means any masterless man in the south of Mexico who is possessed of a horse, a rifle, and a sufficiency of homicidal mania, and it is possible that Zapata himself is as mythical as the Mrs. Harris referred to by Sarah Gamp.

The strong hand that the President promised to use some eight months ago has proved to be of the weakest. The weary federal soldiers march from place to place and the bandits fly before them only to form again when the danger has passed. There is little fighting, for the bandits do not love opposition and their ideas of honourable advancement are chiefly confined to robbing travellers and looting the smaller towns. Their actual necessities are few; therefore they can continue indefinitely under present conditions. Anything like organized resistance to the Government appears improbable since the late abortive attempt of Felix Diaz at Vera Cruz, but among the Mexicans above the peon class, there is a wearied disgust with the man who has produced these conditions and who is unable to cope with them. The reputable citizens are aching for peace, and for them it does

not matter who has the Presidency if they can pursue their occupations and live without the continual menace of disaster. It is to be regretted that although they say, and very often say, that they will fight to the last man in the case of invasion, they do not take to the idea of forming volunteer troops to exterminate the pest that is bringing armed intervention decidedly nearer. It must not be considered, however, that the whole country is in a state of anarchy. There are many parts where it is as safe as in the latter days of Porfirio Diaz, but unfortunately it is not known when the lower element will discover that looting is easier, more remunerative, and about as safe as working by the day. To the resident in the larger towns and on the main lines of railway there is little danger, and with the exception of the movements of troops or occasionally a slovenly unhandsome corpse suspended to a telegraph pole, there is little evidence of the conditions that are paralysing the country.

To foreign investors the situation presents one bright outlook. The native mine-owners are more ready to convert their holdings into cash, and the prices asked at present are characterized by a sweet reasonableness in comparison with the prices asked a year ago. Several mining companies are taking advantage of this, and it is probable that when the long looked-for peace arrives, either by intervention or, what would be infinitely more preferable, by a burst of sanity and energy from the Mexicans themselves, it will be found that many properties will have changed from native to foreign ownership.

Reforma.—It now appears very probable that the Campo Morado deal will go through and that the mines will be acquired jointly by the Camp Bird, the American Metal Co., and the Balsas Pacific Railroad Co. It is not known why the Camp Bird people did not take the whole affair for themselves. A 1000-ton smelter is projected for Tezuapa, which is on the Balsas river about eight miles beyond Campo Morado. The ore is in a series of huge lenses on a contact of granodiorite and slate. It is estimated that there are 10,000,000 tons of low-grade pyritic ore containing copper and silver, and 2,000,000 tons of high-grade oxidized surface ore, which also contains lead. The deal should be a good one, as the low-grade ore gives an almost inexhaustible supply of flux and fuel for custom ores and it is estimated that coke to the extent of only about 4% of the charge would be needed, making it almost straight pyrite smelting. There are three mines in the neighbourhood

that have been well developed, the Reforma, Suriana, and the San Vicente. It is probable that two of these at least would want their ore treated by a custom smelter, and there are many large deposits in the district only waiting for a little peace to be opened up. With the continuation of the railway, this should turn

pesos. The cost, of course, has been high, with coke at 50 pesos per ton. A year ago the mine was shut-down after working for eight months with a new 50-ton smelter. The profit for this time was 500,000 pesos. The bandits paid periodical semi-friendly visits, taking cash and stores to a small extent, but



AN OLD HACIENDA IN MEXICO.

into a new copper district. The Campo Morado mine is all tunnel-work, and the ore can be delivered to the smelter at a low cost. The present owners—the Ortiz family—have worked with a 25-ton smelter for nearly 12 years, and it is reported that they have taken out oxidized ore to the value of 9,000,000 pesos. This appears possible, as they have never treated ore of a lower assay-value than 100

making no attempt to loot as long as they were supplied in moderation. Senor Ortiz says that he has paid 15,000 pesos in cash for permission to work during the eight months. The price asked is illustrative of the reasonableness of the Mexican owners at the present time. It is 10,000,000 pesos, or about half of the figure asked of the Exploration Company two years ago.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

'Ore.'

The Editor:

Sir—There appears to be a great divergence of opinion among mining engineers as to the correct definition of the word 'ore,' so that the ventilation of personal views founded on experience will be of interest to your readers. For myself, I have found the following to be the most satisfactory:

ORE: A metalliferous mineral, or a rock containing such mineral, occurring at any particular place in large enough quantities and in sufficient richness to make its extraction and treatment of advantage to mankind, or even to warrant the serious discussion of such extraction and treatment, immediately or at some subsequent period.

It will be seen that this definition does not specifically refer to 'profit'; it does not appear to me to be necessary that it should do so, for the intention of profitability is implied in all commercial operations, including that of mining. To base the definition of 'ore' on 'profit,' is merely shifting the elusiveness and uncertainty from one word to another; for we have to ask at once: What is a profit? The only true definition of profit is the surplus remaining after all capital and current expenditure has been regained together with interest. Only then is the transaction profitable. A yearly distribution of dividends is not sufficient. For instance, a mine may yield 20% dividends for four years and then become defunct; during those years the operations may be considered according to one definition to be 'profitable,' and the material treated reckoned as 'ore,' but in the aggregate the owners lose money. From another point of view 'profitable' may be given too narrow a meaning and be made to refer only to the owners and shareholders: Take the case of a lead mine where during one year 100,000 tons of material gave a yield of 10,000 tons of lead, at a loss of £5000 to the shareholders. The community was the gainer by 10,000 tons of lead, and the miners had received the means of subsistence, so that we can say that the operations at the mine had been to the "advantage of mankind" in spite of the loss of £5000 to the shareholders, and that they had been on the whole profitable, taking that word in its broader sense. Similarly we can imagine the owner of a tin mine continuing to work it in spite of absence of direct profit to

himself, for the reason that he benefits his community and reaps indirect advantage for himself. I may go further and instance the mining of lead in England in earlier centuries when bullets were wanted to repel the invader and the metal was extracted at no small immediate loss.

Briefly, therefore, according to my view, ore is anything, the mining of which for its metal content is worthy of serious consideration within the limits of present knowledge. Twenty-five years ago the disseminated copper deposits of the Western States were not within the range of discussion and were therefore not 'ore,' simply 'rock.' Rock containing 1½ dwt. on the Rand at the present day is not ore, but that containing 4 dwt. can claim to be called ore, though under present conditions the desirability of its extraction is doubtful.

This definition of ore obviates the undesirable extension of the word 'waste.' This word implies something actually done to disadvantage and should therefore be confined to broken rock that is not worth hoisting or milling. It cannot rightly be applied to rock that has been left in place. Thus we come to three words covering everything in a mine: ore, anything worth a thought; rock, anything not; and waste, rock broken but eliminated from treatment.

EDWARD WALKER.

London, February 2.

Centenillo.

The Editor:

Sir—I beg to draw your attention to the fact that your note with reference to the Centenillo mine, published in *The Mining Magazine* for December 1912, contains certain statements that are somewhat misleading; doubtless you will be glad to have a correct statement of the facts, which are as follows:

Your information with regard to the production is accurate, the output of late having averaged about 2000 tons per month; but no single dividend of 120% has been paid, as your note would seem to imply, although the total dividends distributed to the shareholders in 1912, including two bonus dividends of 50% each, were something near that figure.

It is in regard to the nature of the company working the mine that your information is entirely erroneous; the Centenillo Company is a public company whose shares are well distributed, and in no sense can it be termed a family affair; it is also an entirely independent undertaking, and is not connected with nor in any way controlled by any other firm. Messrs.

Thos. Sopwith & Co. (now the Soci  t   des Anciens Etablissements "Sopwith"), the firm whose name you couple with that of the Centenillo, are owners of lead-smelting works and mines in the Linares district, and as smelters are purchasers of ores: the Centenillo Company as vendor transacts a considerable amount of business with them, that being the only connection between the two companies. I should further state that personally I have never been connected with Messrs. Sopwith.

Since you make reference to me as manager, I feel it incumbent upon me to mention that the man to whom the credit is due for bringing the Centenillo Company to its present state of prosperity, is my uncle, Mr. Arthur Haselden, now consulting engineer and general manager. He has been connected with the management ever since prospecting on the property was first started in the early seventies, and it was his perseverance in the face of adverse circumstances, that kept the concern going through years of a struggling existence, till success was ultimately achieved.

J. O. HASELDEN,
M. Inst. M.M.

Linares, January 25.

Cam & Motor.

The Editor:

Sir—In your November issue there appears a statement regarding the proposed treatment of the ore of the Cam & Motor mine, in which it is said that metallurgical difficulties have caused delay in the erection of the plant and production of gold, since recent experimental work has proved that the plant as originally designed is unsuitable. You further state that the reason for this is the presence of a high percentage of carbonate of lime in the ore, which, in conjunction with the sulphides, tends to form calcium sulphate in the process of roasting, and the latter when wetted with cyanide solution causes the roasted product to set whenever allowed to come to rest in various parts of the plant. Incidentally, it is also mentioned in your article that formerly in roasting Kalgoorlie ore the same conditions prevailed.

As regards the delay in the erection of the plant, I regret to say that you have been entirely misinformed. The original design, adopted about six months ago, on the conclusion of experiments at the mine, has not been departed from, and as a matter of fact follows exactly the scheme which you say has not been found suitable, namely, ball-milling, roasting, mixing with cyanide solution, classi-

fication again, followed by leaching the sand and filtering the slime.

Experiments on a large scale proved that, after roasting and mixing with cyanide solution, the gold dissolved very rapidly, that it was unprofitable to grind to less than 60-mesh, and it was also demonstrated that, owing to the extreme porosity of the roasted and re-ground product, it was practically impossible for the vacuum to hold the cakes on the filter-leaves when exposed to the air during a transfer of pulp. With the fine sand classified out, the residue-slime makes an ideal material for vacuum-filtration; steps were then taken to run the separated sand into leaching vats and wash out the soluble gold, and thereby it was also practically demonstrated this leachable roasted sand did not set like cement.

On the results of these experiments, concluded over six months ago, the scheme of treatment mentioned previously was decided upon, so no delay nor need for alteration has been occasioned, while it is obvious that, there being no necessity for extreme fine grinding, the cost of treatment should be less than if, as you state, all sliming had to be indulged in.

The setting of the roasted ore on the Kalgoorlie field was an event which happened about 14 years ago, when all-roasting of an ore was little understood, and the production of slime a thing to be avoided at all cost, while the actual reason for this hard setting of the roasted product was induced by circumstances which have not been quite fully realized.

The first roasting plant to start, about the year 1898, was the Boulder Main Reef, followed by the Lake View and Associated, and in all these mines the same system of treatment was adopted, namely, dry crushing in ball-mills to 900-mesh, followed by roasting, the roasted product (sand and slime together) being then trucked direct to leaching-vats and leached with cyanide solution for any time up to a month; on proceeding to discharge the contents of the vats, it was found the ore had set into a cement-like mass, and the strange sight was witnessed of men drilling holes in the sand and blowing pieces off with dynamite.

The cause of the setting was due to, as you state, the presence of sulphate of lime in the roasted product, and in a smaller degree, to the not quite perfect roast obtained in the various types of roasting-furnaces then used; the most important condition facilitating this setting of the roasted ore was that in leaching it direct as it came from the furnaces, all the soluble sulphates went into solution; and there

being a very small bulk of this solution passing through the charge, extractor-boxes, and back to the charge again, it was obvious that every facility for this setting of the roasted product was given.

If the extraction of the gold had been satisfactory, the emptying of these cement-like charges was, although expensive, not an unsurmountable difficulty, but it was discovered that, as the roasted ore was sent direct to leaching-vats without any attempt at amalgamation, the residue invariably contained free gold, so that to obtain a maximum extraction, the ore had to be reduced to a slime.

Several tons of roasted residue from the Boulder Main Reef mine were then brought over to the Ivanhoe mine and there re-ground in a grinding and amalgamating pan in the presence of J. T. Marriner, E. S. Huntley, and myself. The results were so excellent that this experiment practically decided the question of successfully treating the telluride ores of the Kalgoorlie field by ball-milling, roasting, amalgamation, sliming, followed by agitation and filter-pressing.

The setting of the sand and slime had henceforth therefore no terrors for Kalgoorlie metallurgists, but, I personally think that, if the ore had not required amalgamating and sliming to liberate the gold, the roasted ore could have been mixed with solution as it left the furnaces, the sand classified out and treated by leaching in vats, and the slime settled in spitzkasten, agitated, and washed in filter-presses, no setting of the sand after leaching would have then occurred: all the soluble sulphates would have been taken up by the circulating plant-solution and accompanied the slime, leaving the sand in a clean leachable state. The Golden Cycle mine, at Cripple Creek, Colorado, I believe, also adopts this method, with no ill effects as regards the setting of the sand in the vats.

In the case of the Cam & Motor, the roasted product leaving the furnaces will be re-ground in tube-mills to the required fineness, the sand classified out of the mill-stream and run on to a sand-filter table; from this the sand, practically free from moisture, will be discharged on to a belt and deposited into ordinary cyanide leaching-vats; the slime will be settled in spitzkasten, agitated with cyanide, and vacuum-filtered.

The final decision as to the design of the Cam & Motor plant to treat the ore was only taken by the Board after a long series of experiments had been made by Messrs. G. F. Dickson and B. L. Gardiner, the representa-

tives of the company's consulting engineers, and myself, and also after consultation with other competent engineers, careful comparison being made with the work in other plants of a similar nature, notably that of the Golden Cycle mine, in Colorado. The final result when the large plant is at work is now awaited with confidence.

H. T. BRETT.

Bulawayo, December 29, 1912.

[We publish this letter with pleasure. It supplements that of Pearse, Kingston & Browne, appearing in our December issue. Mr. Brett, in giving some valuable reminiscences of Kalgoorlie practice, mentions the use of 900-mesh screens. Probably he means 30-mesh. It is an Australian habit to give the number of holes per square inch, while elsewhere it is the custom to state the mesh in holes per linear inch. Of course, we are glad to know that the experimental work of Messrs. Brett, Dickson, and Gardiner has been so thoroughly done, and with such apparent success. Our information came from an unimpeachable source, but we accept the correction.—EDITOR].

Engineers and Income Tax.

The Editor:

Sir—In the *Times* Law Reports for January 13, there is a report of the case of Pickles v. Foster (Surveyor of Taxes).

Cases dealing with the problems that, from time to time, arise out of the Income Tax Acts, are not infrequently of interest to most of us, but the particular case above referred to is of special interest to all those whose work, on behalf of public companies, lies abroad, the company itself having its head-office in the United Kingdom. I venture to think that these circumstances often apply to those who have made mining their profession, and on this account I write in the hope that you will allow me the courtesy of your columns to bring the case in question before your readers, or such of them as have not already noted it.

Before referring to the details of the case I shall quote the following 'summing up' of the result of it by the *Times* Law Reports as follows: "Rule 3 of Schedule E of the Income Tax Act 1842, which refers to 'public offices and employments of profit' within the United Kingdom, means public offices or employments which are exercised in the United Kingdom. A person who is in the employment of an English limited company, whose head office is in England, but who exercises his employment wholly outside the United Kingdom, is not employed in a 'department' in the sense

in which that term is used in sec. 147 of the Income Tax Act 1842. Such a person is therefore not taxable under Schedule E, Rule 3, in respect of his employment so exercised abroad."

The appellant in this case was employed by a company, whose head office was in England, to undertake work for them in West Africa on two separate occasions, the appellant himself having a domicile all the time in England, where his family lived, and where he joined them when in England between his two periods of work abroad. He was paid partly by a fixed rate of salary and partly in commission on net profits, and he further received a sum for keeping himself open to accept the second contract after completing the first. The period spent in England between the two engagements was from June 1907 to November 1908. With the exception of a part of his salary, all the remuneration was paid in England.

The commissioners sought to recover income tax from him on the sums in question or on parts of them. Now, sections 30 and 31 of the Act of 1842 provide for the setting up of assessable districts in the United Kingdom. Section 147 (relied on *inter alia* by the Commissioners in this case) provides that a Government officer serving abroad is to be deemed to be serving at the head office of his department.

The commissioners contended that this employee of a public company was in the same position, and was to be deemed to be serving at the head office of the company (though his work was actually performed wholly out of the country). The appellant won his appeal, and the result appears to be that a person cannot be assessed to income tax under Rule 3 Schedule E, whose work on behalf of a British company is exercised wholly abroad and who is not a Government officer, and notwithstanding the fact that his pay has been given to him in the United Kingdom (*including a sum in the nature of a retainer while in England*) and though he has a domicile in the United Kingdom.

In connection with work done abroad there are one or two other points (governed by Schedule D), which I mention below owing to their general interest, but to which I do not refer in actual conjunction with the above quoted case as—in so far as any one of them may have similarity with any of the circumstances of that case—they were not, I believe, in dispute.

Those points of interest are as follows :

(1) It makes all the difference as regards a person living in the United Kingdom whether he is doing so with the intention of making a residence as opposed to a merely temporary stay. Temporary residence in the United Kingdom must not exceed 6 months in any one year. Furthermore, a person keeping an establishment in any place may be said to have a residence although he does not go there for years. Conversely, a person temporarily residing abroad is liable to tax on the whole of his profits.

(2) No tax is payable on the fees of a person who, though he has a domicile in the United Kingdom, earns his money abroad on behalf of employers domiciled abroad.

C. V. GRUNDY.

London, January 22.

Financial Journalism.

The Editor :

Sir—The articles in the *Pall Mall Gazette* upon which you commented last month, in the article entitled 'Plaintive Shareholders,' raise questions even more interesting and more urgent than the professional standards of mining engineers. It is high time that the limelight was turned upon the financial journalism of today, and, unless I am mistaken, that is going to happen before very long. Fifteen years ago it might be said without fear of serious contradiction that, with a few honourable exceptions, financial journalism was flagrantly corrupt. Then came the Whitaker Wright and Hooley disclosures, and a marked change followed. Today, when corruption is exceptional, and direct blackmail is a thing of the past, financial journalism is relatively honest—not absolutely so, by any means—but it is incurably amateurish, superficial, ignorant, and pontifical. During the last few days we have seen Mr. W. R. Lawson—who, with Mr. Charles Duguid and one or two others, is generally regarded as possessing peculiar authority—under the harrow in the Marconi commission. Confronted with the facts, Mr. Lawson has made a series of admissions which in any other sphere of activity than financial journalism would be simply ruinous to his professional reputation. He has admitted that his articles, which reeked with sinister suggestions against everyone associated with the Marconi contract, rested on rumours which he never verified, that fundamentally his criticisms were based on foundations which were false in fact, and which he had either not the ability or the desire to test; and finally that he had been a 'bear' of Marconi shares. It

is not suggested that Mr. Lawson is dishonest. On the contrary, he is a fairly typical modern financial journalist, only differing from the majority of his colleagues in that he is far abler and better informed than the average; and, as I started by saying, the financial journalism of today is relatively honest. In the atmosphere in which these gentlemen move and have their professional being, it is not considered dishonest to assume pontifical airs about persons and things of which you have incomplete knowledge, it is not considered dishonest to treat rumours as facts provided you believe them, it is not apparently regarded as improper to 'bear' shares which you are criticizing — on the contrary, the operation is merely a guarantee of sincerity. All the same, standards of this kind are the standards of the quack and, sooner or later, the reading public will realize the fact. The comments of the *Pall Mall Gazette* upon mines and mining engineers are in a sense a far worse case of charlatanism than that of Mr. Lawson. Some years ago there was a rather painful scandal in connection with the financial columns of the *Pall Mall Gazette*, and since that time it has been pure, cocksure, critical, and stupid. The writer, who I imagine would be hard put to it to distinguish between cyanide and cement, writes every day about mines for the benefit of British investors, and is honestly anxious to protect them. He is aware in a hazy sort of way that mining swindles have been perpetrated, that mining engineers or people thus describing themselves have been mixed up with these regrettable occurrences, and that promoters and directors have been tarred with the same brush. Moreover, he has grasped the fact that troubles of this kind are more often associated with mines than—let us say—with banks or railways, and he has from these data proceeded to draw certain illuminating generalizations. I do not think that it is worth while considering them in detail. Certainly the Institution of Mining and Metallurgy can afford to ignore them, especially as the financial editor has by this time probably realized that there is such a thing as the Institution and that the professional standards of its members are quite as high as those that obtain in law, medicine, or the church.

The *Pall Mall* is however right on one point, and that the most important of all. The public is tired of mines and suspicious of them, and it is no doubt of interest to analyse the causes and remedies. The important causes are, I suspect, beyond remedy by direct or conscious effort. There is a fashion

in investments just as there is in women's hats, and just now mines are not fashionable. The Rand has long years of profitable production ahead of it, but it has reached and passed its apogee, and there is no longer that margin for imagination without which mines lose their attraction. It is all too scientific and calculable. No longer does the mining 'investor'—who is at heart a gambler—experience the delicious thrill of seeing in his morning paper that the reef on his property is going x ounces to the ton at the fifth level. The most he can hope to learn is that a new stope-drill gives promise of becoming economically successful and cheapening production by a penny or two per ton. But the public does not thrill over stope-drills. Then again trade has been good for years, and no man in his senses buys mines when he can make a high and certain return by investing in his own business. There are other good reasons which could be adduced for the general apathy, but times change, and I fancy that a falling off in trade and the discovery of a new goldfield would alter present conditions almost magically. But these causes are not dependent upon individual control. Personally, I suspect nearly all the remedies and suggestions put forward even in your columns. I can see no reason for example why the Board of Trade should be asked to appoint a director on the board of every mining company. The percentage of such officials who would not be a mere hindrance and nuisance would be necessarily small, and a hundred officials could not guard against the inherent chances and mischances of mining. I gravely doubt whether swindles would be prevented, save perhaps a few of the grosser sort, and I cannot believe that any commensurate advantage would follow from an official sanction of the doctrine that mining is necessarily a dishonest business. As a fact, which is well within the knowledge of every one acquainted with the City of London, mining is infinitely cleaner today than it has ever been. Promoters are less imaginative, directors more industrious and efficient, and mining engineers are far better educated than was the case twenty years ago, while the professional standard is such that today any man who can put M.I.M.M. after his name gives a reasonable guarantee both of knowledge and honesty. Much, no doubt, remains to be done, but the development toward better things has made quite remarkable progress of late years, and it is more likely to be retarded than helped by most of the proposals put forward. Almost the only sugges-

tion which I could advance which is likely to be useful is that financial writers about mines in the daily and weekly press should acquire a reasonable amount of knowledge, both about mining and the men connected with it. They should learn that mining is inevitably and necessarily a risky business, and that any investor who wants steady interest and absolute security would do better to stick to Government securities, provided he knows something about the Government. They should realize their obligation to distinguish between the failure which is due to the disappointment of favourable expectations underground, and the failure which is due to mismanagement. At present they always head their articles: "The — Scandal." and never take any more trouble to ascertain the facts than did Mr. W. R. Lawson. They should remember the elementary truth that the public do better to buy mines when they are discredited and cheap than when they are booming and dear. At present the London newspaper merely helps to exaggerate existing tendencies. In a word, writers about mines should know something about them, and you, Sir, who have already done such good service by establishing *The Mining Magazine*, might do worse than engage in a campaign for educating our educators, by starting an elementary mining school for financial editors.

DIRECTOR.

London, February 4.

Debentures in Mining.

The Editor :

Sir—I have read the criticism by Mr. A. G. White on my contribution concerning "Debentures in Mining." Mr. White contends that the amortization of capital advocated by me confers a benefit on those who may purchase stock in a mining company some years after the commencement of operations at the expense of the earlier investor. He claims that the dividends that may have been declared would be curtailed to the extent of the amortization rate. In his opinion he states that this is undesirable inasmuch as the mining industry is in greater need of the investor who invests at the start of operations, than of the one who may come in later.

I am obliged to Mr. White for his criticism, but I do not think his point is well taken. Although it is true that dividends would be curtailed to a more accurate condition of true profit, the value of the share certificate would be increased in cash assets. This can be substantiated by investigating the book-value of

the shares of Esperanza Limited some five years back when the ore reserve in that company's mines was comparatively small, but where a cash reserve had accumulated to approximately one pound per share. Prior to the acquisition of the Santa Gertrudis mine by the Camp Bird, Ltd., the shares of this company was in a somewhat similar condition, as the ore reserves of the Camp Bird mine were waning rapidly. If the book-value and the market-price of these shares be compared, and of many other mining securities that are well known in both the English and American markets, it will be seen that nothing steadies the market-price of a mining stock better, and on more wholesome grounds, than liquid assets.

Making the amortization-backing divisible to shareholders on the termination of mining operations, as advocated in my contribution, would be a decided step in adjusting the English income-tax laws as applied to mining enterprises to a reasonable basis. As things stand at the present time, in the event of a mine declaring a million dollars in dividends, the Inland Revenue Commissioners would tax this sum on the same basis as a similar profit derived from a shipyard or some other *constructive* industry. The fact has no weight with the Inland Revenue that in the case of a mine this production is made at the expense of the original capital, which is automatically destroyed in the production of profit. It is my opinion that if English mining companies were to arrange an amortization rate to be divisible to shareholders on the termination of operations, the Inland Revenue would only be entitled to tax the interest that would have accrued on the amortized funds. This subject is very broad and deserves more time and attention to detail than I can afford. I may say, however, that it was the unreasonable income-tax laws in England in treating *constructive* and *destructive* enterprises alike that was the inception of the method of capital amortization advocated by me in your issue of November.

MORTON WEBBER.

New York, January 28.

The Knowledge of Tin.

The Editor :

Sir—Having read your article on this subject, in the January issue of your Magazine, with considerable interest, may I be permitted to offer a few comments thereon?

To say that most Cornishmen would be satisfied to have for their epitaph "He knew tin" is showing a certain amount of ignorance

of the average Cornish mining engineer's qualifications even when knowing tin includes the understanding which you assume it should do. I think most of them would like to have added "and a general knowledge of the mining and treatment of other minerals," and you would seem to admit their right to this addition by the first few words of your article. If, however, one could have for his epitaph "He discovered how to profitably recover all the tin in his ore" he might be justly satisfied without any further reference to other abilities, and Cornishmen would feel deeply indebted to him whether he be one of their clan or an uitlander. Again I doubt if the average Cornish engineer is shocked because the "uitlander in London" doubts whether he knows his business; he is not so easily shocked, but I think the uitlander from London and elsewhere has sometimes had a shock when he has come to Cornwall to make money out of tin propositions where Cornishmen have failed because they did not know tin and how to treat it. There are, of course, exceptions to this, and I think the same can be applied to almost any mining field.

There has been much discussion of late as to whether the vanning-shovel test or the chemical assay is the better to use. My own opinion is that it is wise to use both; but if I were compelled to choose one only of the two, I should take the vanning test because what can be obtained on the vanning-shovel can be got in actual practice, and in these days of improved concentrating machinery can even be exceeded. The vanning-shovel does what the chemical assay does not do: it shows the condition of the tin to be treated, that is, whether it is finely disseminated in the ore or whether it is coarse and easily concentrated. The chemical assay merely shows the actual amount of tin in the ore and is of no service with present concentration methods in helping us to recover the amount the assay shows. I can quote cases where engineers have been badly fooled in trusting only to chemical assays of tin, though they might also have been misled by trusting to the vanning-shovel, if they did not "know tin." However, the best plan is to use both the vanning test and the chemical assay. The latter indicates the actual percentage of tin being lost in the concentrating process and acts as an impetus toward experimenting with a view to reducing that percentage of loss. With regard to our methods of treatment in Cornwall, I think those who have at all closely followed the industry will admit that considerable improvements have been made in our tin-dressing or tin-concentration plants in the last 20

years, or even in the last 10 years. The introduction of various tables such as the Buss, Wilfley, Record, and others, together with classification, have not only given us better concentrators of tin than the buddle, on which our forefathers depended, but these tables with proper classification have enabled us to crush our ore to a much less degree of fineness than used to be thought possible. Although I scarcely agree with Mr. Fischer Wilkinson's idea of using a 4-mesh, I think it is by adopting comparatively coarse crushing in the first instance and re-grinding certain middling products from which the cassiterite is not entirely freed from its matrix that improved extraction has, and will take place. I am aware that some of the tin in Cornish ores is extremely fine and to liberate these minute particles it is necessary to crush to a slime, but if there is any comparatively coarse tin present it would seem a pity to also slime this in order to free the finer particles. My experience is that in using 14-mesh screens in front of our stamps quite 65% of the cassiterite is freed and even with this mesh some is freed to such an extent that it escapes into the Atlantic; some 20 to 25% is bound up with silica and other impurities, but the particles have sufficient specific gravity to enable them to be thrown up as a separate middling product, which can be re-ground by tube-mill or other grinding apparatus; while the remaining 10 to 15% is bound up chiefly in the coarse sand-tailing from the tables and partly in the finer sand. But I think the bulk of this 10 to 15% is so fine that it would be difficult to concentrate the tin if it were freed by further crushing, and I am of opinion that it is as well to leave it go on to the sea with the waste in which it is encased as to bring the whole to a fine pulp and still lose the bulk of it. However, this depends on whether any more can be extracted at a profit. There is no doubt that a considerable loss occurs through the necessity of having to concentrate the tin up to 65 to 70% metal in order to get the smelter to pay the best price per unit, and I believe all smelters, whether Cornish or otherwise, pay a higher price per unit for, say, a 70% concentrate than for one containing 60% metallic tin. Coarse crushing does not, unless carried too far, deter one from easily reaching what the smelter considers a high-grade concentrate; in fact, it helps to do so, because the coarser you can keep the particle of tin the more easily is it concentrated away from lighter waste, and there is less fear of losing it.

JOSIAH PAULL.

Camborne, February 4.

JOURNEYS IN NIGERIA

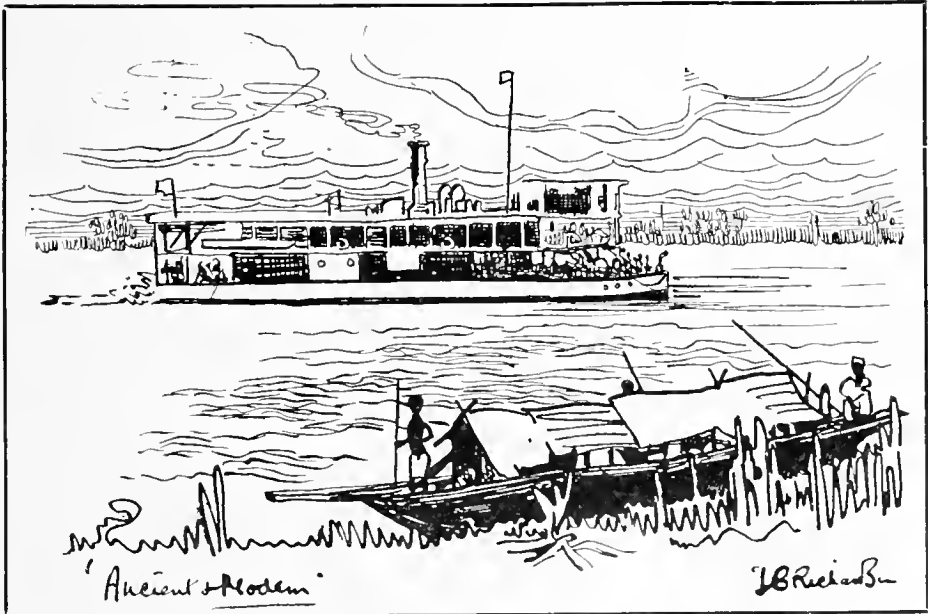
The second portion of an article recounting experiences on the Niger and along the new railway. Illustrated by the author himself.

By J. B. RICHARDSON.

LOKOJA, at the junction of two of the biggest rivers in the world, the Niger and the Benue, snugly lying in the shadow of Mount Patti, was the original capital of Northern Nigeria, and is by its natural position the most important town on the rivers, as regards Europeans and also natives, both of whom do a tremendous trade here, especially the natives who daily throng the markets and the wharves. Some of these black traders are quite prosperous, even according to western notions.

ed in leaves, skins, and cloths to keep them at exactly the right degree of moisture. Then off go the small itinerant traders to the most distant parts of Hausaland, where a good kola will fetch sixpence or a shilling, ten times as much as at Lokoja.

The European town is mostly low-lying, but the bungalows and offices are well built, and the roads and paths and streams are kept in excellent order. It is here that you had better get what articles are missing from your



A CONTRAST.

This town is the largest centre in Northern Nigeria for the kola-nut industry, a trade that, despite several attempts, has never as yet suffered any serious European competition. Every coasting liner and up-going river-boat carries large bales of kolas, that wonderful stimulant nut on which a native will keep up his strength and work for many hours without any food at all. On Lokoja beach they are unpacked, picked, and sorted, and made by their Hausa owners into smaller and more portable bundles, carefully pack-

kit, because the Lokoja stores are easily the biggest and best stocked in the country, and you can get most things, from a bicycle to dress-shoes, as you will never get another chance anything like as good up country.

Convict labour is employed to keep Lokoja clean and sanitary, and it is certainly a peculiar sight to see on the quays two gangs working side by side, one of soldiers and the other of convicts, unloading Government stores from lighters, and strangely enough it is not considered at all a slight by the soldiers. A

convict, or any prisoner in Lokoja, is merely an object of pity among his fellow natives, and not in any way looked down upon or considered to be dishonoured. You may hear, from those who ought to know, of cases where two rival European firms have haggled for months to get the services, when he should finish his term of penal servitude, of a native clerk, cast into prison for stealing or worse!

The real native of Lokoja, apart from the large drifting population that exists in any trading centre of this type, has one absorbing hobby, and that is the shipping. He will tell you the name and owner of any boat miles before you can distinguish even what it is. He knows the history of every sternwheeler, launch, steel barge, and that of most of the native trading barges, and can tell them all at sight by some small distinguishing point in rig or colour.

It is possible that you may have to live on board for the stay of two or three days that most white men make at Lokoja. If you do so, you will be the victim of a dual pest, the small trader by day, seeking to cheat the unwary by selling curiosities at absurdly high figures, four or five times the price at which you will be able to get them up-country, and, secondly, the insects by night. You cannot use a lamp along the river edge at night; it is best to eat before dusk, and go to bed admittedly conquered by circumstances, to be roused at dawn by the cheerful bugles of the garrison, which lives to the left of the town, down river, on rising ground beyond the hospital.

The white inhabitants of Lokoja are white indeed. The heat is unbearable in the hot season, and the shelter of Mt. Patti only aggravates it, so that, despite the fine recreation grounds where tennis and polo are always going on in the cool of the day, the European always presents a limp and washed-out appearance: yet some of them manage to remain several years without leave, and somehow keep their health as well.

When all your business at the bank and the stores and sundry offices is finished, you depart for Baro and the railway, a short two days' steam up the Niger, above the confluence with the Benue. The landscape of both sides changes, with series after series of the flat topped laterite hills, often strikingly picturesque, especially at dawn and sunset, when the tone and colours seem so much softer, and all the delicate colouring and the beautiful tints of distance more refined than in the harsh glare of the tropical sun, with the haze

above the baked landscape that makes the strained eyes ache and tire. But there is a point about the scenery that is unaffected by hour or the time of day, and that is the everlasting sameness of it: there is so much of one kind. When your eyes first see the laterite hills you cannot stop admiring them, but after a whole day of them, all much alike, you begin to lose interest in them, and after several days you begin to pine for a patch of something quite different—a hill that is not rounded or flat-topped, or a huge plain or swamp. After that you cease to have any interest in that type of landscape at all.

There is another sensation, produced by slow travel and a round bend in the course of the river combined, of a similar kind, and that is when you notice a particular hill before breakfast, prominent for its peculiar shape or colour. Hours pass while you have been busy on other things. You look round and see the same peak looking only slightly different, in apparently the same direction. You notice it again after tea, and get a feeling that you can't get away from the beastly thing, and you breathe a sigh of relief when nightfall or a sudden turn in the river blots it out of sight in a few minutes.

The villages along this stretch of the river all fly distinctive pennants, as do the large barges and poling-canoes. The settlements themselves seem larger and better kept, and give the impression of greater traffic and prosperity than those lower down the river, but perhaps it is only because of the much more open character of the country.

Baro, situated at a fairly sharp bend in the river, is recognized some way off by Hospital Hill, but only after rounding the bend do you come into full view of the wharves and landing-stages, with the shipping alongside, sometimes at high-water, including two or three ocean-going boats, for Baro is, and always will be for many years, the big goods dépot of the Northern Nigerian railways, because of the facilities for transshipment at Forcados and the cheapness of river-transport, especially for heavy cargoes.

Not until you are close to the landing stage do you get a good view of the sheds and offices and the track of the river terminus of the Baro-Karo line, and you land in the middle of the busy throng of labourers unloading barges and lighters, greatly relieved to be at last on dry land again, and quit of the cramped space and discomforts of water travel you have had to endure since Liverpool.

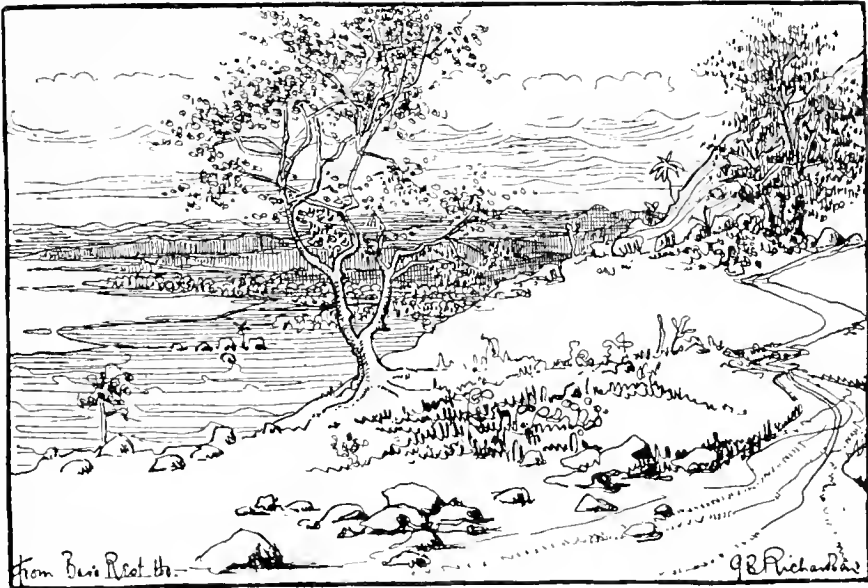
The town of Baro, the river terminus of

the Baro-Kano railway, really consists of two distinct settlements. The busy commercial part is down by the river and along the railway: it is a collection of wharves and stores, sheds and offices, all scattered about a small riverside basin, enclosed by the hills, always stifling and steamy, with gangs of almost naked labourers noisily loading and unloading trucks and barges, engines whistling and rivetters and mechanics hammering with might and main. There is no shade, except under corrugated iron roofs, which make the interior of the sheds more like an oven than the outside air; and here, too, is situated the native town and market, a damp, unhealthy-looking place.

vants awaiting the train to take them north to their stations or the boat to take them down-river and home.

Baro has the reputation of being extremely unhealthy, and undoubtedly the percentage of deaths is large, but it must be borne in mind always that it takes the invalids from the whole of its division of the railway. The construction of tropical railways and the work thereon is not the healthiest occupation in the world.

The Baro-Kano railway, which is now constructed as far as Kano, with a branch small-gauge line to the Bauchi plateau, two or three years ago was by no means in such good work-



NEAR BARO.

A great contrast is the other part of Baro, on Hospital Hill, a little plateau of about 50 acres, a couple of hundred feet above the river, cleared of bush and trees, well laid out with gravel paths and embryo gardens. Up here are the well-built bungalows and offices for the European officials of the line; and the hospital, with its staff of English nurses, lying farthest down-river, a quiet, peaceful retreat, its restfulness accentuated by the noise and bustle below.

This little isolated settlement, perched on the hill, overlooks long reaches of the Niger to the north, and is only accessible by long winding roads and paths. On the steep river slope of the hill are situated the rest-houses, good, solid, roomy buildings, for the convenience of European wayfarers and their ser-

ing order as it is now. In the wet season, especially, travelling was not reliable, and it was no uncommon thing to wait in the rest-houses for nearly a week before it was convenient to make up a train to make a three or four days' journey from Baro to the Kaduna river, a distance of a little over 200 miles.

The train always started well, with a fine, heavy engine of the biggest class, the open trucks loaded with rails and sleepers for the line ahead, cases of provisions and tools belonging to the passengers, and over all a crowd of chattering excited natives—men, women, and children, with their bundles and pots, playing and clambering about for all the world like a troupe of monkeys. Behind the long line of trucks would be one, or perhaps two, brake-vans of the usual type, containing the

passengers and as many of their belongings as they could crowd into the small space, to make themselves comfortable: bedding-bags piled in a corner, a table, one or two folding chairs, packing-cases with tinned provisions, a stove, and a few necessary pots and pans. Six or seven Europeans would sometimes be crowded in a van, usually with one or two steward-boys attending to their own particular master's wants and getting in everyone else's way. Such a collection would form a congested community, more especially at meal-times, or when retiring for the night. When a van became over-crowded at meal-times there arose the necessity for erecting tents in the pouring rain because there were no vacant huts near-by; we then partook of a sodden meal, clad in mackintoshes and hats, while the rain steadily dripped upon the table and the food.

Although the ordinary passenger still continues to travel in brake-vans, saloon and sleeping cars of the splendid and comfortable type used on the Government railways of India were on the line some years ago. These were fitted with mosquito-proof compartments, with two bunks, one above the other, and cook-houses and bath-rooms at the ends of the coach.

Travelling in such a manner, with nothing much to do except admire the scenery as the train slowly traverses mile after mile of monotonous bush, cooped-up in a hot, stuffy van, tends to make the smoothest nature eruptive, so that travelling on the line then was a tedious and irritating process at best. The big engine would take the passengers as far as it was able, cautiously feeling its way, stopping to consider the advisability of going over any weakened track, until it reached a place that it could not possibly negotiate. Then it would stop altogether, and the train would have to wait until an engine not quite so weighty came up from some siding or other down the line to take it over the bad place, which is most probably an undeveloped 'wash-out.'

'Wash-outs,' which are found in great frequency at the height of the rainy season, are a great source of trouble on this line, where no heavy ballast is obtainable, except at great expense. A gully that is a perfectly dry and insignificant stream bed for ten months of the year, suddenly develops into a raging torrent, and in a few days undercuts the sandy embankment, making a new course for itself, and washing away all the dirt on which the line is laid, leaving many yards of rail with the accompanying sleepers suspended in air, sagging in a beautiful curve, like the switchback rail-

ways seen at fairs and pleasure grounds in more civilized regions.

When the engines had been changed until quite the lightest on the line could possibly go no farther, the wretched passengers would have to make camp on the spot, living in tents, or, if in great luck, in an abandoned construction camp, with their goods and chattels piled up. They then had to sit and admire the moist landscape for a few days, until carriers could be brought from up-country, and horses purchased in the neighbourhood for the party to ride.

Horses bought near the railway, as a general rule, are not so inexpensive as the £10 or so paid for them would seem to indicate, as more often than not they are for sale because the owner is only too glad to get rid of them at any price, so that he is delighted to find a man who must buy a horse at once, the position being such as to allow him to hold out for any apparently reasonable figure he likes to name, and being bought in a 'tsetze' district, the poor brutes do not usually survive many weeks of hard trekking.

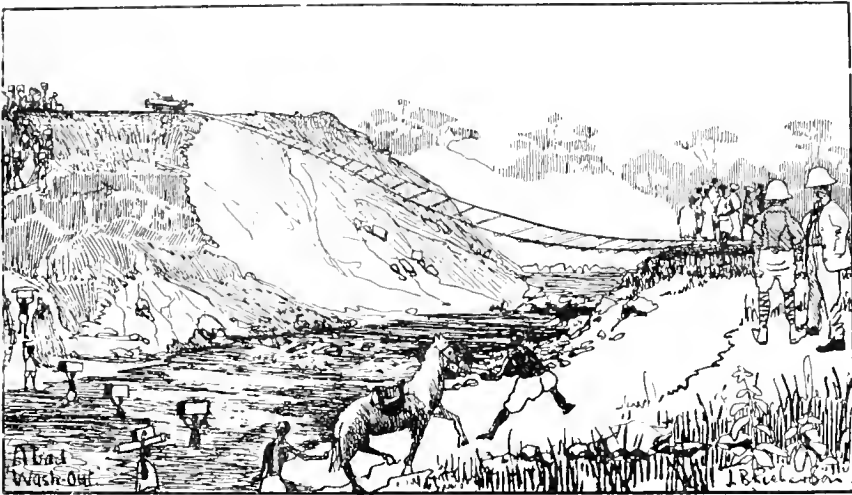
With the co-operation of European transport-officers and local native chiefs, sufficient carriers and more or less efficient horses eventually would be obtained. Then a move forward would be made after this last delay of days spent in dodging the rain outside and the drops inside the hut or tent, in venturing out into the surrounding bush, consisting of rank grass and thorny scrub, to try and wile away the time by shooting at something, or anything, and in grumbling at the weather, the country, and the rest of the party.

When anyone has experienced several times a delay of two or three days on a journey, it is with a feeling of vast relief that he finds himself independent of boats and railways, no longer at the mercy of officials, but able to rely on something that does consistently move forward, however slowly, and no longer to experience that awful feeling of coming to a full-stop and not knowing how long it will be before he can go ahead. For this reason it is a most welcome sight to wake at dawn and see a gang of waiting carriers, sitting on their haunches gossiping, surrounding the tent and piles of provisions, with the head-men and the interpreter standing together, looking important and awaiting orders to strike camp and get away.

Experience with negro carriers is required in order to strike camp and get away comfortably without wasting time. The interpreter and head-men must direct each man to his

place and show him his load, otherwise there will ensue the most glorious scramble imaginable in taking-down the tents, and a fierce rush and quarrelling over what are considered the lightest loads, while the majority of the cases will be forlornly left lying in a neat row. If you speak a few sharp words to the interpreter you may be sure of their being passed-on tenfold to the head-man, who will threaten the carriers, or will say probably that the white man threatens them, with the most awful punishments if they do not take up their proper loads. Then they will set to work quickly and without any bother, and file out along the track ahead, to the accompaniment

The beautiful catenary curves of steel hanging in mid-air, formed by the suspended rails and sleepers, as mentioned before, usually hung over a torrent anything up to 16 ft. deep and full of rocks, so that should anyone fall in, the chance of coming out whole was very slight. The method of crossing was to sit in the hand-trolley, which was propelled by two natives, who ran behind and developed a maximum speed near these curves. Letting go at the top of the dip, they sent the traveller flying across the chasm, swaying and rattling in the little car, which seemed every second about to topple into the roaring foaming torrent below, until it slowed up along the even track



A BAD WASH-OUT.

of shouts and whistles, in a long uneven line, finishing with the personal servants glorified with carrying field-glasses, water-bottles, guns, and mackintoshes, and, lastly, the leader of this tiny army, the white man, mounted on a sorrowful nag, that, half trotting, half walking, manages somehow to be persuaded to keep pace with the carriers in front.

On a bad track, where there is a lot of bog and stream to cross, a horse is often only a nuisance. Along the railway at that time there were many streams and wash-outs, all with plenty of thick mud, in which a horse would flounder for hours, unless the rider alighted in three or more feet of mixed bog and stream, so that it was preferable to travel by means of a hand-trolley. This adventurous way of travelling across the bad places has the advantage of being quick; and perhaps the spice of danger adds to the enjoyment.

on the other side, safely across in a minute instead of a tedious half-hour passage through mud and water. After a point where the rails had spread or broken, or for some other cause even the hand-trolley could proceed no farther, it became a straight trek to the Kaduna river, alongside the line under construction.

After Baro, the next big station is Minna Junction, where the Zungeru extension line joins the main Baro-Kano railway; up to this point, even three years ago, the line was in good working order at all seasons. Minna is quite an imposing station, having a large extent of track and big sidings with engine-sheds. A number of Europeans live in good bungalows on the low hills to the north. There is a considerable native town and market half an hour's walk from the station. After Minna, the line traverses open bush and does not touch at towns of any size until near the Kaduna

river, although there are a good many camps and collections of huts, used by the engineers in constructing the line, that make suitable rest-camps for the traveller.

The rest-houses along the route taken by the railway are built on the usual native pattern, but they are better constructed and on a larger scale, in some cases quite roomy affairs: round mud huts, 25 ft. in diameter, with walls a foot thick, and a verandah; the mud pillars supporting a double conical roof, 7 ft. high inside the verandah, rising to 20 ft. or more in the main chamber, quite water-tight, and consisting of one thatched grass roof on another, which affords ample protection from the heat of the sun, leaving the house inside cool and pleasant. The floor, like all the floors of well-built huts, is made of good clay and freshly crushed locust beans, a sticky mixture, which, when beaten vigorously, forms a kind of cement, hard and durable. Sometimes the doorways and windows would be highly ornamented with rough drawings and designs made when the clay was wet. These houses are comfortable and dry, and would be ideal but for certain drawbacks, the chief of which is a bird, not unlike the house-martin, that appreciates the dryness and comfort, and it is no uncommon thing to find a cluster of nests inside at the apex of the roof.

On the journey by the side of the railway it is borne upon the mind that the building of railways in the tropics is indeed no healthy task, for more than once the traveller passes a solitary white man's grave: just a small cairn of stones built round a rough wooden cross made of two small branches of bush timber, standing back from the track, out of the way of the passer-by, in a tiny clearing in the virgin bush, a simple mark on which no name or inscription remains to show who he was or what he did.

The crossing of the Kaduna river at the end of the 'rains,' before the steel and concrete bridge, that now spans it, was built, was no slight affair. The stream at that time of year is about a quarter of a mile to 600 yards broad at the ferry point: not too broad for a man's voice to carry across it, but the current in mid-stream on the top of the flood flows to the Niger at a rate of anything up to 10 or 12 knots, so that a poling-canoe travels several miles before reaching the farther bank, a good bit lower down-stream than it started.

The river is crossed in a crazy dug-out, in which the pole-men stand up and navigate with long sweeps about 16 ft. long, made from

the centre stem of a riverside palm. On the wet slippery bottom of the canoe they sway about, with the rest of the occupants crouching on the bottom as low as they can, until in mid-stream the clumsy craft tips over so that it seems bound to overturn. When a canoe-load of people does upset, they are probably all drowned, as the current and the plentiful supply of crocodiles are a great deal too much for the average swimmer; for, though most of the coast and down-river 'boys' can swim like fish, the ordinary carriers and Hausas generally are not at all expert, and are usually of a far poorer physique too.

A 20-ft. dug-out cannot carry more than about eight men and their loads besides the pole-men, and as it takes an hour and a half to two hours for the journey across and back, it occupies the best part of a whole day for a European with all his kit and provisions to make the crossing. He is a lucky man if he loses nothing in the process, as it is dangerous enough under the best of conditions. But in the hurry to get on he may over-load a canoe, or when the horses are being towed across, a scrambling, frightened, plunging beast may become unmanageable and upset a boat-full of men and cargo.

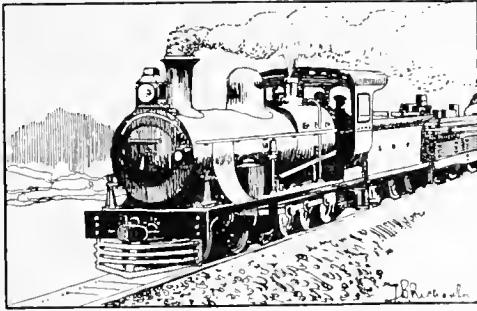
The crossing safely accomplished, there only remains a short journey by a narrow winding track, through several pools and small streams to the town of Rigachicham, the point at which the Bauchi road branches off, and where there used to be a fine rest-camp, situated between the railway, the road, and a rather smelly native town.

The Bauchi road, which stretches from the railway right to the heart of the tin-mining district, runs in its general direction south of east, and although its place has now been taken to a great extent by a branch light railway, it is, and was, a great convenience to the engineers on trek to the mines. It is a good road, an extremely fine road for the country, where a few hours' rain will cut out a deep broad trench across the track, and where a month or two after the commencement of the rains any ordinary road becomes a mere string of quagmires and ditches. Being well drained, it does not get cut up, keeps its good surface, and is quite possible for rough wheel-transport at all seasons.

At Rigachickam, on the railway, the trek starts and the road goes straight away from all signs of civilization into the Northern Nigerian bush—mile after mile of small scrub and thorn bushes, studded here and there with scraggy trees, and occasional copses of small

thin-foliaged trees, in a sea of tall coarse grasses.

Soon after the start the traveller is out of sight and sound of the railway, and he and his men form a solitary little caravan, with a long ten days' journey along the broad high road. With nothing to delay, except a strike or desertion on the part of the carriers, there is nothing to do but to jog on, day by day, perhaps completing 15 miles, perhaps 20.



Advancing civilization.

It inspires a pleasant state of mind to be commander of a little travelling community, with no one to interfere and no one to dispute authority; to see your well-packed loads in front of you on the heads of the sturdy line of carriers, your interpreter and servants close by you, while you on your horse travel last to encourage the stragglers and to see that nothing is left behind. Naturally it is tempting to travel ahead of the men, and get the day's journey over, leaving them to come in as they like, but it is a dangerous proceeding, as some seductive little village just off the road may tempt them to stray, and beguile the most trustworthy servants, causing you to wait hours for a chair to sit upon and food to eat.

It simplifies matters if there is more than one white man in the party. Then it can easily be arranged to take duty in the rear of the caravan alternately, so that one goes ahead and covers the journey as quickly as he likes, taking with him (if he is sensible) a blanket and a book, as well as smoking material. However, there is not much to be gained, and unless you know exactly where to put up, it is not hard to find your way to the wrong village and wait in vain for carriers that never come.

The road is quite good enough for cycling even in the wet season, and then a whole day's journey can be covered in very few hours, except when a swollen stream crosses the trail, when it may mean a three or four hours' miserable wait in the rain, until the labourers overtake.

The majority of the carriers in Northern Nigeria are drawn from the ne'er-do-wells and idle portion of the town communities, those who are too lazy or too adventurous for an agricultural life. Many are Hausas, with a general admixture of other races, but all of them use Hausa as a common tongue. They are a cheery class as a rule, and do their work quite well if properly handled, that is, with sufficient firmness, so that they understand that they must obey the white man's instructions implicitly. They are sure to try to make trouble, demanding extra pay or a day's rest, and if they do once get the upper hand, they will never forget it, and will have everything their own way with that particular white man to the end of the trek.

Everything depends on the head-man; he can work so much on behalf of the white man and do so much against him. In fact, if the



On the beach at Lokoja.

labourers give trouble, it is not a bad plan to punish the head-man as a matter of course, because he is sure to be at the bottom of it, and, anyhow, he is supposed to have authority over his men.

If the men are punished for whatever they do intentionally wrong—not threatened, but punished—or given a slight reward for good trekking and are cheered by the leader on a

long trek, they soon tumble to the state of affairs and see that it is best to keep going properly. After the first day or so they will get together, put their best man in front, and go ahead at their regulation three miles an hour as cheerfully as possible, laughing and joking from start to finish.

One of the most striking incidents on the trek up-country is the ceremonious greetings of the *serakis* of the villages and towns passed through. The title seems to apply to anyone, from the ruler of a small hamlet to the native prince in command of a big district. As soon as the white man is safely ensconced in the village rest-house, a small procession, varying according to the wealth and importance of the particular chief, comes into view—the Seraki himself, dressed in his best robes, escorted by one or two of his relatives and his second in command in the village, all dressed in the long embroidered flowing robes and turbans of the better-class native, almost invariably followed by two or three almost naked small boys of the Seraki's household, carrying the *dash*, or present from the chieftain to the white man. They approach the door of the hut, where the white man receives them reclining in a deck-chair, and graciously exchanges greetings, or, if he does not speak Hausa, his interpreter does it for him. The greeting is rather lengthy; each party inquires after the other's health, and wishes the other luck for the journey, the work in hand, the next harvest—anything that comes to mind; in fact, it becomes a sort of polite duel between the interpreter and the Seraki, one or the other bursting out with some fresh gust of well-wishing, interrupting for a few seconds the ceaseless flow of *sanu* and *lafia*.*

When both sides of this struggle in courtesy have exhausted their stock, the Seraki, who has all this time been on his bended knees in front of the white man, bowing at each salutation, takes up a more comfortable pose, and calls forward the small boys, who lay the *dash* at your feet: skinny chickens, eggs, yams, guinea-corn, and whatever else happens to be in season and plentiful.

At the end of the second day's journey along the road, the town of Fanshanu is reached, a walled Hausa town situated on the Shika river, an important stream in the rainy season, with a canoe-ferry just above the town. The typical native ferry is almost invariably placed at some place where there is a large tree at either bank. At these rest-trees the passengers patiently wait, sheltered from sun

or rain, until it is their turn to cross. If a large caravan is crossing, the travellers may be kept waiting for hours under the tree. Then cooking-pots are unpacked and fires are lit, while the ferry-man from the town near-by laboriously poles canoe-load after canoe-load across to the farther bank.

The chief ferry-man, who is commonly a servant of the local Seraki, usually demands a small toll from the native travellers, and begs a much bigger one from the European.

In the ordinary course of things, a good many streams provided with a ferry may easily be crossed by a man on horse-back, but a sharp thunderstorm will cause a stream to rise three feet in as many hours, for the sudden rush of surface water pours into the stream all along the bank, with the same effect as a bucketful of water thrown on a door-step flows over the edge on to the path below, and then the horseman cannot get back without the canoe. But he finds the canoe tied to the farther bank, the ferry-man gone to shelter from the storm, and he either has to shout his lungs sore to attract attention, or sit down and with African patience wait for the stream to subside.

It is only for a few months in the year that the bad storms are experienced in Northern Nigeria, but for the rest of the year there is the fierce sun and dust to endure, so that it is hard to say which is more pitiless, for both sun and rain beat unmercifully upon the traveller's back in this region of stunted bush and shadeless trees.

As the road follows no trade-route, and simply cuts across country, there are not many large towns and markets on the way, and the majority of the stations are only roadside camps placed at certain points, and supplied with provisions at ordinary prices, from the nearest town and by the orders of the local authority.

After Fanshanu the next place of interest is Dan Malaki, a curious little town perched on the top of a hill, which is capped by a large irregular granite outcrop, shaped like a huge boulder, round which the little walled town is gathered. It is a picturesque and healthy site, but the main impression it gives is that it was built there for defensive reasons.

Along this part of the road, in fact, until Rahamma is reached, there are not many signs of activity. It is a quiet pastoral zone, situated between the ever-busy river region and the newly active tin district. The inhabitants of this peaceful part, perhaps because they are so much of the soil, do not seem as

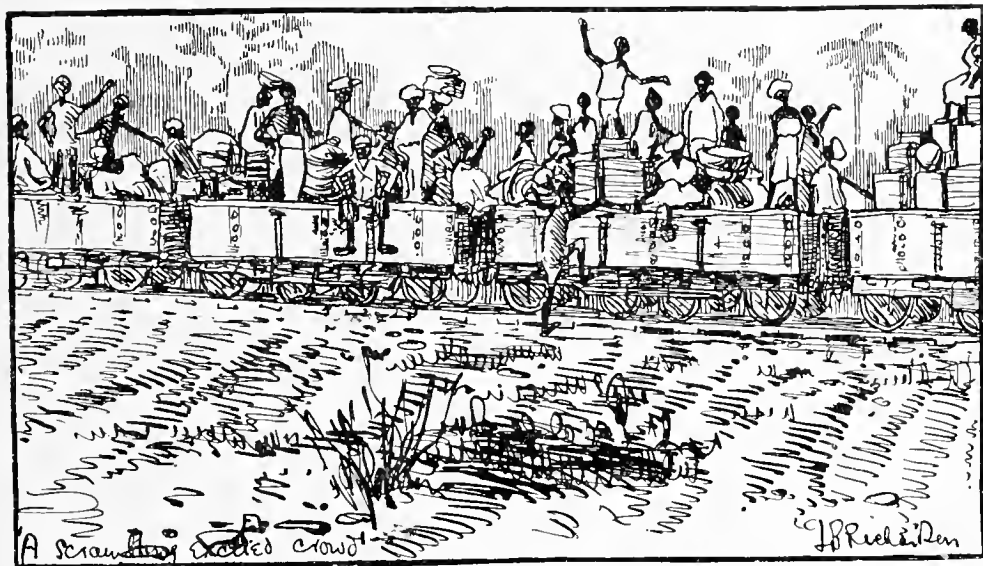
**Sanu* is Hausa for hail or good day. *Lafia* means good health.

intelligent as those along the railway and in the country ahead.

The journey as far as Dan Malaki, through the low-lying country, is not exciting, and as the pleasure of being away from the railway, with its officials and delays, wears off, the monotony of trekking forces itself upon you. Trekking would be pleasant enough if it were not so slow and if it were not advisable for the traveller to stay with his carriers. It is the eternal sameness of the bush you are going through, at not quite three miles an hour, hour after hour, day after day, that wears upon you.

waters of the Kaduna, on which the town is situated, and are built on rising ground. Two years ago they consisted of two groups of huts at either end of a large sandy parade ground, but now, of course, Rahamma is an important station on the Bauchi branch railway, and was for a time rail-head, and before that was a collecting station for tin on the road.

At this point the traveller has the choice of two roads: either he may go on to the metropolis of the tin country, Naraguta and Jos, and the government road will take him there direct, or, if his work lies north of that, he had



A NIGERIAN TRAIN.

The bush resembles nothing so much as an immense common, such as are found near London, with thorn bushes instead of gorse and brambles, and sparser trees, all dried and burnt brown in the dry season and half-hidden in bush grasses in the wet. The scenery is more interesting after Dan Malaki, as the road steadily rises to Rahamma.

The market and village of Rahamma are important, for it is here that the road strikes the main trade-route from Bauchi to Zaria. There is a constant stream of traders, going east or west with their bundles of wares, and it is no uncommon sight to see a large number of horses and cattle for sale at the weekly market, for this is where the traveller enters the real horse and cattle country, the journey up to Dan Malaki being well within the region of the tsetse fly.

The European quarters are situated on the eastern bank of the river, one of the head-

better take the old trade route to Bauchi. Both will take him into the land of bold granite hills that he can see so clearly to the east, for from here the land rises step by step high and away from the basins of the great rivers. Rahamma is on the edge of the plateau.

The Future of Oil-Fuel formed the subject of a lecture delivered before the Royal Society of Arts by Vivian B. Lewes on February 3. The world's production for 1912 was between 40 and 50 million tons, of which $1\frac{1}{2}$ million tons was imported into Great Britain. The production had been doubled during 10 years, but only by the multiplication of the number of wells twenty fold. The future depended on the development of new oil-fields. The lecturer considered 50 years as the limit during which oil-fuel could be obtained in commercial quantities.

THE HISTORY OF THE WAIHI MINE

Telling how one of the greatest gold mines of the world was discovered and developed.

By J. McCOMBIE.

IT is now more than 34 years ago since I started prospecting in the Ohinemuri district, New Zealand, in company with an American, named Robert Lee, who has passed out to the Great Beyond, and there still is a strong fascination for me in the remembrance of that time. The free life and self-dependence, together with the fact that one never knew today what tomorrow would bring forth, had an attraction of its own that can only be understood by those who have had similar experiences.

About the month of February 1878, we travelled eastward of the known belt of mining country then comprised within the Waitekauri district. This took us in the direction of Waihi, where there were then no Europeans, and only a few Maories, who lived on the banks of the Ohinemuri river at a place about one mile from the present Waihi township.

Long before arriving at the scene of our subsequent adventures we could see the quartz comprising the outcrop of the now famous Waihi lode glistening in the sun, and, when we came to the Maungatoetoe stream, the first dish* of rubble that we panned showed some 'colours' of free gold. Here was convincing proof that we had entered upon a belt of auriferous country, and we hastened toward the outcrop so plainly visible on the ridge of the Pukewa hill, which rises out of the plain to a height of about 250 feet. On arriving there, a cursory examination of the lode made it appear to be about 20 feet thick. It had a general north and south strike, with a perceptible easterly dip. The enclosing country we called 'andesite.' The quartz was laminated and discoloured in many places by manganese oxide. Samples, when crushed and panned, yielded a little free gold so extremely fine as to be scarcely visible except under a magnifying glass. As the outlook generally was more promising than anything previously encountered during our prospecting tour, we decided to pitch our camp, and give the outcrop a trial. The following day we commenced cutting trenches across the lode at intervals, and we

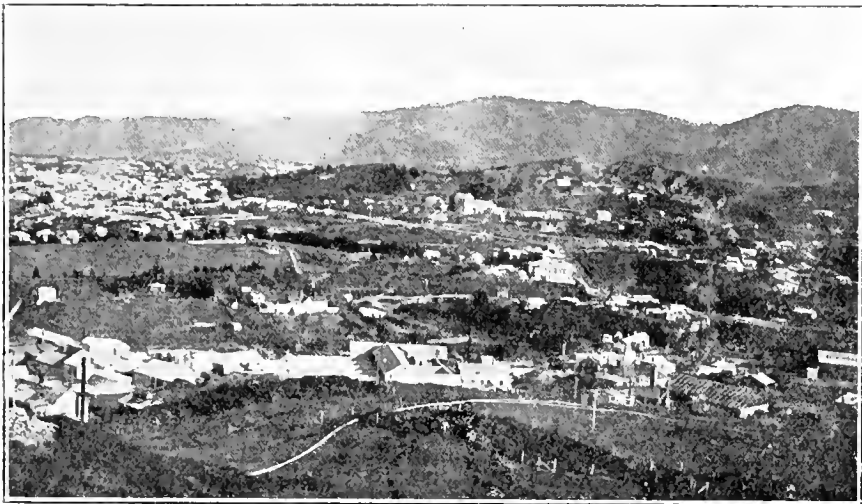
got four prospects of free gold at every place. The richest ore being obtainable at the northern end of the outcrop, we resolved to exploit the lode in that direction at a depth of about 80 feet beneath the surface, by means of a cross-cut to be driven from the western side of the hill for a distance of about 200 feet. We set about the preliminaries at once. The first fourteen days were occupied in conveying tools from Waitekauri, building a 'whare,' or camp, and burning charcoal for tool-pointing purposes. The country-rock being favourable to progress we advanced the cross-cut at the average rate of three feet daily.

Early one fine morning, when our cross-cut had been advanced about 100 feet, we were visited by two hoary-headed Maories, who told us that Pukewa was a burial place, and insisted upon our suspending operations at once. This we quietly but firmly declined to do. Our visitors returned to the village. Next morning the old men returned, in company with several young ones, and a number of women, who were armed with *taiahas* and other weapons of primitive warfare. As soon as I caught sight of the advancing army of Amazons I knew from experience that our troubles were about to begin, for I attributed this raid to the grasping greed of a so-called 'white man,' who wanted to be a sleeping partner with us. The spokeswoman—an aged crone—addressed herself to me in a tirade of abuse that would have done credit to a fish-wife, while several buxom dames took occasion to emphasize their leader's remarks by waving their weapons in dangerous proximity to my face. Throughout these interesting proceedings Lee was working in the cross-cut, and at last he came out with a barrowful of stuff broken from the face. This he tilted over the tip head, and, when about to go back, three dusky ladies seized the wheel-end of the barrow, and a general struggle ensued. For a time my partner held his own, but eventually he was overpowered, and was drawn with his barrow toward the tip-head, which was about 40 feet in depth, tapering gradually away in the direction of a fern-covered terrace. Just when the trio reached the extreme edge of the

* The Australian prospector uses 'dish' as a synonym for pan.

tip-head, which they had not noticed, Lee let the barrow go, and I shall never forget what followed. There was a momentary struggle on the part of the women to recover their equilibrium, but the effort came too late, and away they went, taking turn-about with the barrow in the matter of ground and lofty tumbling. It may have been ungallant, but Lee and I enjoyed the performance, laughing all the while most heartily. Maories have a keen sense of the ridiculous, and our laughter raised their temper. Assisted by their friends, the amateur acrobats pulled themselves together, resumed their weapons, and made straight for us in a most threatening manner. Believing

the small opening just in time to see them well covered by a heavy fall of earthy matter. Then we returned to the face of the cross-cut, where we had scarcely ensconced ourselves when we heard a double-barrelled explosion outside, followed by loud exclamations of surprise on the part of the Maories. This was followed by a general hubbub, which gradually died away in the distance. Then we thought it safe to make an exit. A few minutes of hard shovelling enabled us to force our way out, and we hastened to the top of the hill in time to see the Maories tramping in Indian file eastward to the coast. That night we decided not to do any more work until we



WAIHI: with Martha Hill in mid-background.

discretion to be the better part of valour, under the circumstances, we sought refuge in the cross-cut, where we remained for fully an hour listening to the choice epithets that were hurled at us by the excited viragos outside. While this was going on we had prepared a couple of charges of blasting powder, with long pieces of fuse attached thereto ready for emergencies. It was a happy thought, because, finding that they could not lure us out, the Maories combined their forces to pull down the walls of the open-cut leading up to the mouth of the cross-cut, and it looked as if they intended burying us alive. We considered it time to retaliate. Stealing quietly out under cover of the darkness caused by the filling of the open-cut, we lit the fuse attached to both powder charges simultaneously, and watching our opportunity, threw them out of

could ascertain what our coloured friends were likely to do. Next morning we were not surprised to observe the same crowd of Maories put in an appearance at the mine, which was in full view of the 'whare' or camp, and not more than half a mile away. It took them some time to realize that we had no intention of resuming work that day, and eventually one of the party favoured us with his presence. Taking it for granted that I understood his language, he delivered a long oration descriptive of the system under which he and his people had been robbed of their lands by the Government, both past and present. He charged Lee and me with desecrating an ancient cemetery, where his ancestors had been consigned to mother earth long before there were any thieving white men in New Zealand. Should we persist in our search for

filthy lucre on the sacred Pukewa, our camp and belongings would be burnt, and we ourselves would be slung like pigs on long poles, and carried out of the district. Compensation to the amount of £1000 would not assuage the grief of his people for disturbing the graves of their forefathers, and, in his young days, he had seen white men tomahawked for a much lighter offence. So far as the men were concerned we knew there was nothing to fear, but, having no desire to meet the women in a free fight, we strolled about the camp for a long time. Day after day, from sunrise to sunset the Maories kept watch and ward over the cross-cut, until, wearying of the enforced idleness, we determined to euchre them by working at night. Superstitious to a degree, they never gave us any trouble after dark, and the cross-cut advanced just as rapidly as would have been the case had we worked in daylight. Now they began a succession of petty annoyances, extending over several weeks, and culminating in a complete clearance of everything portable in our camp. This robbery was carried out when we were away on a game-shooting expedition, and the plunderers had a long start before we became aware of our loss. Nevertheless, we went off in pursuit, following the trail till darkness hid it from view, and then we were reluctantly obliged to retrace our footsteps. That night we dined on roasted pigeons, and next day we journeyed to Waitekauri, where we purchased a fresh supply of food and clothing.

For fully a fortnight we took turn-about watching the camp and driving the cross-cut, and thereafter we were allowed to continue our work in peace. Within four months of the time of starting, the cross-cut penetrated the lode, which proved to be 17 feet thick. On the foot-wall side, for a width of 2 ft., there was a vein of laminated ore, which yielded fair pannings of fine gold, and the remainder of the orebody contained only colours of the precious metal. We broke two tons of ore, which we conveyed on bullock-sledges, at a cost of £5 per ton, to Owharoa, where it was crushed in the Smile of Fortune battery.

Previous to treatment we had taken average samples, which were assayed at the Bank of New Zealand, Thames, with the following results: bullion 4 oz. 6 dwt.; gold content 1 oz. 2 dwt.; silver content 3 oz. 4 dwt.; value per ton £4. 14s.

After cleaning-up our trial crushing the yield was 1 oz. 3 dwt. bullion, worth £2. 17s. 6d. per oz., realizing £3. 6s., which did not represent more than 35% of the real value of the

ore. Armed with the results of this crushing, as well as the assay-certificate setting forth its contents before treatment, we did not anticipate much difficulty in obtaining the necessary capital to exploit the mine, but, in this respect, we were off our reckoning. The whole concern was reported upon most unfavourably by everyone who paid the place a visit and who considered themselves authorities on the subject of gold and silver mining. Briefly, all the leading experts, acting on behalf of capitalists, politely informed us that they could not conscientiously advise their principals to put up any money for development, and that no one but an enthusiastic optimist would have anything further to do with it.

Even now, at this distance of time, I often have a quiet laugh to myself when I think of the opinions expressed on the Waihi in the early days, and, especially when such opinions are compared with the performance of this great mine.

The total quantity of ore extracted from the Waihi mine and treated up to the end of 1911, is 4,000,000 short tons, which yielded bullion to the value of £9,785,431. After liquidating all costs and charges up to the same date, the net profits enabled the company to pay the sum of £4,563,165 to the shareholders in the shape of dividends.

Altogether we spent nearly twelve months on our prospecting claim, which is identical with the Waihi mine of today, without being able to enlist one penny of capital for development purposes. Then we heard that gold had been discovered at Te Aroha, and we hurried away to the scene of the new discovery. During our absence our workings were visited by a Coromandel prospector, named Nicholls, who was so favourably impressed with the showing that he induced his backers to apply for several claims along the line of lode, and these embraced the area contained within our prospecting claim. This necessitated a plaint against Lee and myself for non-working, and the Warden decided in favour of the applicants. The new owners took out a trial crushing of about 15 tons, which was treated at the Smile of Fortune battery, Owharoa, and the bullion return was satisfactory. Then four distinct companies were formed, and their respective areas, ranging from 5 to 15 acres, were located along the line of lode for a length of over half a mile.

Vigorous development in the different claims revealed a large orebody carrying a fair percentage of gold and silver at every point of intersection. The Martha and Waitete com-

panies let contracts to H. H. Adams for the erection of two separate batteries, which comprised 10 and 20 stamps respectively.

The system of treatment then in vogue was ordinary amalgamation, commencing in the mortar-boxes, continuing on short apron-plates, and terminating in a shallow trap placed at the bottom of the plates. Next in order came blanket strikes for catching the concentrate, which was ground subsequently in Berdan pans. The gold occurred in such a finely divided state that the total recovery did not exceed 25% of the content.

Outside of the bank bullion purchasing departments the only complete assay-plant on the Ohinemuri goldfield in those days was owned by Charles Rhodes (now local director of the Waihi company) and myself. It was at Paeroa, where we assayed a number of samples of tailing taken at intervals from the Martha mill, the returns ranging from 15s. to 40s. per ton. At that time no account was taken of the loss in float gold, which, I believe, would average fully 14% of the original contents.

Both batteries were run for a time, but the returns did not cover the cost of breaking and treatment, and, consequently, mine after mine suspended operations. At this juncture, two speculators, named Fraser and Darrow, took a twelve months' option on the Martha section of the present Waihi mine. During the early part of that time they advanced a cross-cut, affording about 100 ft. of backs, from the eastern side of the hill, and, after driving a long distance, intersected the lode, which measured about 20 ft. in width. Here the ore was comparatively low-grade, and the gold contents were not amenable to ordinary battery treatment. At any rate, the option holders forfeited their deposit, folded their belongings, and left for other parts.

Then there was a long period when very little work was done, and 'expert' after 'expert' condemned the property. Eventually the Martha company bought up the surrounding mines, and consolidated all the claims into one holding. The late J. H. Moore was appointed manager, and the selection was a good one. Under Moore's economical management about 30,000 tons of ore was treated for an average return of 7s. 6d. per ton. This just about cleared the cost of mining, transit, and milling, without leaving any profit for the shareholders. As there were no indications of any dividends in the immediate future, the directors of the Martha company let their mine and mill on the tribute system to Hollis and

party, the consideration being 10% on the gross bullion receipts. The tributors continued mining and milling for a long time, during which they did not recover sufficient bullion to liquidate general expenses, and, toward the end, they only worked intermittently. In the meantime the shares were practically valueless, and the property was hawked about the mining markets of the world, for the sum of £3000, without finding a purchaser.

I must now go back several years in order to explain the preliminaries that led up to the introduction of English capital, and the subsequent formation of the Waihi Company.

The Union lode is situated east of, and is supposed to run almost parallel with, the Martha lode system, being distant therefrom about half a mile. During the early days of the field several claims were located along the strike of this lode, the principal one being owned by the late P. C. Hansen and H. M. Shepherd. These two men did a lot of development work on their property, and, although the lode was small, some of the ore was exceptionally rich in bullion—silver predominating. Some time in the year 1887, J. W. Walker, who owned the adjoining claim, secured an option from Hansen & Shepherd. Then he went to London, where he succeeded in floating the Waihi Gold Mining Company, and, with the aid of the late Thomas Russell, obtained sufficient capital for mine-development and mill-building purposes. Mr. Walker, who was the first superintendent of the Waihi company, visited California, with a view to ascertaining the best method of treating ore similar to that at Waihi, and, after examining various treatment plants, he decided to adopt dry crushing and pan-amalgamation. The first plant comprised a rock-breaker, crushing-rolls, ball-mills, and amalgamating pans. The ore was dried in kilns. Within the first year the rolls and ball-mills were scrapped, and stamps substituted. Dry crushing and hot pan-amalgamation were then continued under more favourable conditions. By this method of treatment the bullion recovery averaged 60%, but the lode was small, patchy, and on the whole the prospects were not encouraging. Early in the year 1889, when things generally were on the down grade, T. H. Russell appeared on the scene. This man was not versed either in mining or milling matters, but he was gifted with strong will-power, and there is no doubt he laid down the foundations of the extraordinary success that attended the Waihi company's affairs subsequently.

At that time Thomas Melville had a six

months' option on the Martha mine, and the amount of the purchase money was £3000. Melville tried hard, but failed, to place the property in Glasgow, and at the expiration of his term, Russell secured an option on the same conditions. He then arranged with Hollis and party, tributors, to mine and deliver at the Waihi company's mill 500 tons of Martha ore, but the actual outcome of this test was never made known. It was evident, however, that the proceeds enabled Russell to pay the tributors for their trouble, as well as to complete the purchase of the Martha mine. Later on, in 1890, Russell sold his rights to the Waihi company for a share consideration, and then he retired from the management. The first superintendent sent direct from London was Henry Dale, who died within a year of his appointment, his successor being H. P. Barry, who has retained the position ever since.

Under the new regime tramway connections were effected with the Martha section of the property, and the capacity of the mill was duplicated. All the tailing resulting from the treatment of ore by pan-amalgamation was sluiced and deposited on a basin-like strip of land in close proximity to the pan plant, and here the residue was allowed to accumulate until the tonnage ran into five figures.

About the beginning of the year 1893, Alfred James, representing MacArthur & Forrest, patentees of the cyanide process, paid a visit to Waihi for the purpose of persuading the Waihi people to adopt the cyanide process, which was then in use at Karangahake. While there his attention was attracted by the dump of tailing, which he purchased on behalf of his principals for the sum of £5000, this being the first attempt to treat old tailing by cyanidation. James erected a suitable plant for handling the tailing, and the subsequent bullion returns spoke for themselves.

The management of the Waihi company was now convinced that it was only necessary to employ cyanidation in order to make the mine a dividend-payer. No time was lost in making the requisite alterations in the plant. This was the turn of the tide: thenceforward the mine never looked back until it reached the summit of its prosperity during the year 1909, when 416,813 tons of ore was treated for a yield of £959,594. Mining operations were then in full operation at No. 8 level, where several lodes, which were entirely distinct in the higher levels, seemed to converge, forming an immense orebody, ranging from 70 to 90 ft. in thickness, and carrying rich ore throughout. This was known as the Edward

lode. One cross-cut from wall to wall proved the ore to average £11 per ton.

For the year 1910, 442,020 tons of ore was treated for a bullion return of £926,100. During the year 1911, the output dropped down to 350,699 tons, with a corresponding fall in the bullion, which realized £697,113. This serious reduction in production can be attributed to the fact that none of the lodes, except, perhaps, the Royal and Empire, maintained their size and value going down. At No. 9 level there was a decided decrease in both respects with regard to the Martha and Edward lodes, which had been the principal producers in the past. To account for this I cannot do better than quote from R. E. Williams's report on the subject:

"The serious set-back in the history of this mine occurred at No. 9 level during the progress of the cross-cut from No. 4 shaft to No. 6 shaft. After passing through the Martha lode decomposed rock was met, similar to that found near the surface, which undoubtedly is a very bad indication the world over. I have noticed in the several fields that I have been connected with, that, where a good class of country is replaced by a soft decomposed rock, it is an unfavourable sign, and it is my honest opinion that this development will not prove an exception to the rule."

Since Williams wrote the foregoing his diagnosis of the case has been fully confirmed, and the all round results at No. 10 level have been most disappointing.

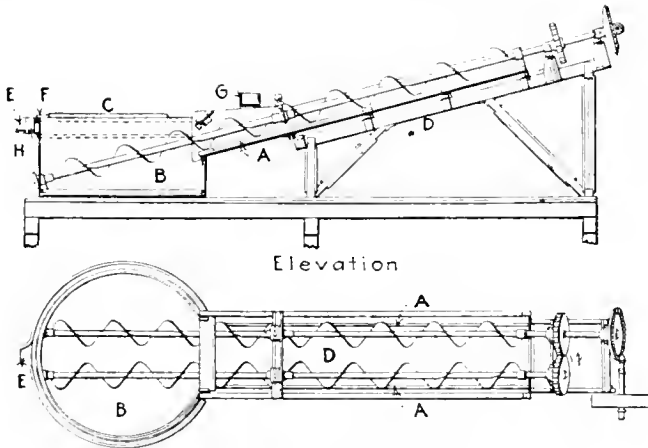
Although this mine is now under a cloud, who will venture to assert that exploitation below No. 10 level will not reveal a second zone of ore infinitely richer and more extensive than the first one? That the management have strong faith in this possibility is shown by the fact that they intend sinking the main shaft to a depth of 300 ft. below No. 10 level, before opening out for lateral development, and it is quite on the cards that their efforts will be crowned with success.

Leaving the Martha lode-system out of the question altogether, the Union and Silverton lodes have not yet been tested below the 400-ft. level, and, as they were both richer in bullion in the upper workings than any part of the Martha lode-system, they offer a fair field for exploration by cross-cutting, say from the No. 8 level. This would intersect them at or about the random of the richest sulphide zone in the parent mine, and it is only reasonable to assume that the work would be attended by satisfactory results.

PRÉCIS OF TECHNOLOGY

Argall's Classifier.—For some time Philip Argall has been using a classifier, invented by himself, at Stratton's Independence for separating sand from slime. This he calls the 'Ovoca,' as recorded in his article in the Magazine for November 1911. Particulars of its construction were not then given. The machine is described in the *Engineering and Mining Journal* for January 4. Two spiral conveyors rotate in opposite directions within an inclined trough *D*. The pulp is fed through the launder *G*. The conveyors carry the settled coarse sand to the top of the trough, and the fine sand and slime overflows into channels between angle-irons *A* and the sides of the trough. The conveyors rotate slowly at from 3 to 8 revolutions per minute, and as they turn in opposite directions they squeeze the smaller particles out of the sand into the discharge channels. They also remove a large proportion of the moisture. The fine sand

carbonic acid, and alternations of heat and cold, but without practical result. Others have used costly reagents such as hydrofluoric acid, which though producing potassium salts, was useless from the commercial point of view. A third class of reactions involved the volatilization of the potash compounds; in particular the process of Eckel is of note, involving the recovery of potash salts as by-products in the flues used in cement manufacture. The collection of the potash compounds in this class of process has presented unsurmountable practical difficulties. One of the most interesting methods proposed was that of the Societa Romana Solfati, an Italian company. Their proposition was to roast leucite with soda and lime compounds, and then to pass steam through the roasted material. The soluble products were potassium carbonate and sodium aluminate. It is stated that though the product was excellent, the cost was too high. Rhodin proposed to produce a chloride by heating felspar with lime and salt, and similar pro-



ARGALL'S OVOCA CLASSIFIER

settles in the circular tank *B*, and the slime and water are discharged over a circular weir *F* into the launder *H*. By means of dams *C*, the length of the weir can be varied. If the whole of the weir is open, the discharge over is slow, and consequently the slime is extremely fine. But if the weir is narrow, the discharge is more rapid, and less of the fine sand settles in *B*. By varying the weir and the rate of revolution of the spiral conveyors, a delicate adjustment of the classification into sand, fine sand, and slime can be obtained.

Potash from Rocks.—As we have recorded on many occasions recently, American chemists are searching for supplies of soluble potash salts suitable for use as agricultural fertilizers. Much study has been devoted to the production of such salts from igneous rocks. At the recent international Congress of Applied Chemistry, held at New York in September last, A. S. Cushman and G. W. Coggeshall read a paper describing their own process. The paper was made additionally interesting by a preliminary chapter reviewing the work of previous investigators. The silicates available commercially are orthoclase and leucite, both potassium aluminium silicates. The kaolinization of these felspars by weathering releases the potash, and in the natural rock-changes the soil at the base of igneous rocks containing potash are rendered fertile for this reason. Several inventors have tried processes intensifying the natural reactions, using heat, pressure,

processes were tried by McKee and by Cushman. Thompson tried producing sulphate by heating felspar with salt and bisulphate of soda. The process introduced by the authors consists of making a powdered mixture of 100 parts of potash felspar with 20 parts of lime and 10 to 20 parts of rocksalt, and treating thin layers of it with a strong solution of calcium chloride. The latter combines with the lime to form an oxychloride cement, and the result is the production of nodules about the size of peas. These are heated in a cement kiln, thereby producing potassium chloride. At the present time it is proposed to use the discharge from the kiln as a fertilizer without removing the chloride from the earthy matter by leaching.

Concentration of Iron Ore.—The December *Bulletin* of the American Institute of Mining Engineers contains a paper by N. V. Hansell on the concentration methods adopted in the United States in connection with iron ores. In some cases the concentration is employed for raising the iron content of low-grade ores, and in others for eliminating injurious constituents. In many cases also it has been found advantageous to dress the ore because thereby a more uniform material can be obtained than is possible when treating even a high-quality raw ore. The Lake Superior mines furnish 80% of the iron ore used in the United States, and for the past 10 or 15 years the average grade has been falling by 0.5% yearly, so that

the study of concentration is becoming imperative. In other districts, as in the Southern States, some sort of washing has always been necessary, in order to make the brown ores and sandy hematites suitable for smelting. The author describes in outline the various methods of concentration now in use. In the Southern States, the iron compounds are found in the form of boulders and nodules in residual clays. The material is treated in log-washers, and the product sized—the oversize is hand picked on belts, and the finer parts jigged. The slime is at present washed, though experiments are being conducted with various tables and with magnetic separators. Generally the ratio of concentration is 3 or 4 to 1, and the iron content of the concentrate is usually from 40 to 46%. In the western Mesabi range, similar type of plant is in use for treating the hematite ores which occur as layers alternating with sand. Here the Overstrom table is in use. In none of the above cases is it necessary to crush. In Canada some of the low grade specular hematites are crushed and jigged. The crushing is coarse, and the fine, which contains much iron, is lost, so that the practice is not on a thoroughly economic basis. With the recent advent of the improved Woodbury jigs, now generally adopted in the Lake Superior copper region, it is probable that the future expansion of jigging as applied to iron ores will be notable. As regards magnetic separation, both dry and wet methods are in use. The best and largest installations of dry magnetic plant are at Mineville in New York State. The object here is to reduce the phosphorus content. One ton of ore produces $\frac{3}{4}$ ton of concentrate, the iron being raised from 51% to 64%, and the phosphorus reduced from 0.2 to 0.08%. Dry treatment is only economical where the ore is coarsely crystalline, for the fine is drawn away and lost. Otherwise, the wet-magnetic method must be adopted. There is a wet plant at Lebanon, Pennsylvania, and one at Moose Mountain, Sellwood, Ontario, both using the Grondal process. The Moose Mountain plant is the newest, and is thoroughly up-to-date. The ore is comminuted to less than 30 mesh in a Jordan impact crusher, and passed through Grondal machines. The tailing is re-crushed in Hardinge mills, and re-treated in another separator. One ton of ore yields $\frac{3}{4}$ ton of concentrate, the ore assaying 36% iron and 0.072% phosphorus, and the concentrate 65% iron and 0.02% phosphorus. The agglomeration of fine concentrate is done in three ways in America: (1) nodulizing in revolving kilns; (2) blast roasting by the Dwight-Lloyd and Greenawald processes; and (3) briquetting by the Grondal method.

Mr. Hansell also mentions the drying of low-grade ores undertaken with the object of expelling the substantial amount of water which these often contain. In particular, he mentioned the Goltra process used at Waukon, Iowa. In the contributed discussion, E. G. Spilbury gave additional information about the process. The orebody at Waukon is a clay bed containing nodules of hematite varying from boulders to small grains. The average content of iron is from 22 to 26%. Mining is done by steam shovel. The ore, after the removal by screens of the largest boulders, is sent to horizontal revolving kilns, 155 ft. long and 10 ft. in diameter. The heating in these furnaces is done gradually, so as to prevent the transformation of the clay into masses of brick, and to leave it in a finely divided state. It is thus possible for the hot blast introduced at the discharge end to easily blow the fine clay particles away. The discharged ore is plunged immediately into water, with the result that the chert and quartz become easily distinguishable

from the iron compounds. The quenched material goes to revolving screens, the oversize from which is delivered to picking belts. Here the gangue can be easily removed. The material passing the screens goes to another set of revolving kilns. These kilns are sealed, and oil fuel introduced, the result being the production of magnetic oxide. The material discharged from these furnaces is sent to dry magnetic separators. It is stated that the Goltra process produces a concentrate assaying 66% iron, as compared with 46 to 48% concentrate produced by the washing system hitherto in vogue.

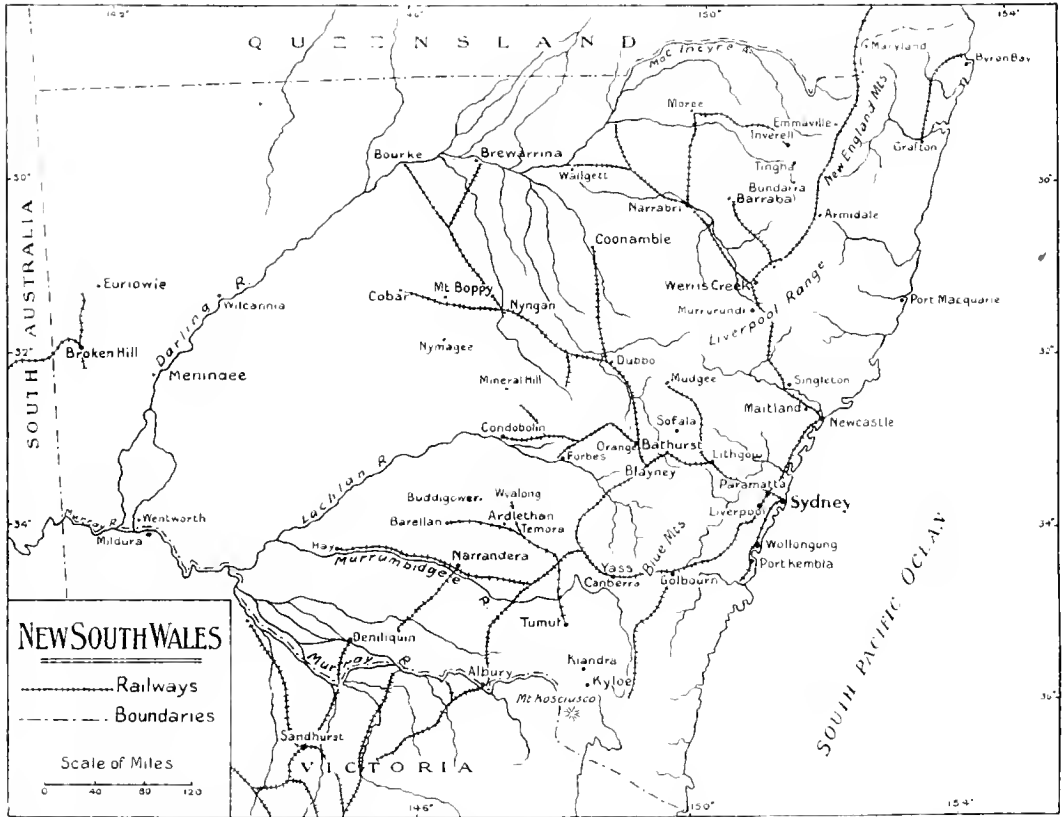
Platinum Refining. In the *Journal of the Franklin Institute* for November, H. F. Keller contributed an article entitled 'Platinum, the Most Precious of Metals,' in which he described the various platinum minerals, the properties and uses of the metal, and the metallurgical processes of extracting and refining. The last-named part of the paper is of special interest. The crude platinum from the placers almost always contains admixtures of other metals, which must be removed before the platinum can be made malleable and ductile. For many years the difficulty of refining prevented its use in the arts. In the latter part of the 18th century, several continental chemists and metal workers experimented on the subject, but it was not until 1800 that Charles Knight, an Englishman, devised a satisfactory method. This consisted in dissolving the crude metal in aqua regia, precipitating the chloride solution with sal ammoniac, and heating the dried spongy precipitate in conical fire-clay moulds. The metal was thus obtained as a coherent mass, which could be hammered into various shapes. The product however lacked the solidity and homogeneity necessary for making thin sheets and fine wire. In 1828, Woollaston described, in one of his lectures, a modified method of conducting the reaction whereby a much greater degree of malleability and ductility was obtained. The lecturer was credited with the invention, though in fact the method was devised by Johnson, Matthey & Co. According to this method, the double chloride of platinum and ammonium was carefully heated to a temperature just high enough to expel the ammonium salt, so that the precipitated particles of the metal should not cohere. The precipitate was rubbed by hand fine enough to pass a lawn sieve. The powder was mixed with water into a paste, placed in a brass cylinder and squeezed. The hard cake thus obtained was heated over a charcoal fire to expel the water and promote cohesion, and finally heated to the highest temperature obtainable in a wind-furnace. The white-hot cake was consolidated into an ingot by forging under a heavy hammer, and the solid metal thus produced could be beaten into thin sheets and drawn into fine wire.

The fusibility of platinum was demonstrated in 1758, but it was not until 1847 that large amounts were melted. This was done by Robert Hare, of Philadelphia, who used the oxyhydrogen flame for the purpose. His process was developed and improved by the French chemists, Deville and Debray, who introduced it into commercial practice, replacing the process described by Woollaston. Deville's furnace consists of quick-lime hollowed to form a crucible or hearth. An opening at the side serves as a spout for the molten metal and for carrying the fumes away. The nozzle of the oxyhydrogen blow-pipe is introduced through an opening in the centre of the cover. Lime is infusible before the flame, and it also has the advantage of absorbing the slag formed during the operation. The platinum sponge melts like butter before the flame. The process is used at all the refineries.

Tin Lodes in New South Wales.—Our Melbourne correspondent referred last month to the discovery of a tin lode at Ardlethan in New South Wales, and he mentioned that the deposit was attracting an unusual amount of attention. The *Australian Mining Standard* for December 12 devotes much space to this subject and reprints in full the report by E. F. Pittman, Government Geologist, published at the end of November. This deposit is situated about 220 miles due west of Sydney, on the railway between Temora and Barellan. It is about 30 miles south of Wyalong, one of the gold-mining districts of the State. Practically the whole of the tin hitherto produced in New South

Wales has come from the northeastern end of the State, and has been obtained from placers. Lodes have been found from time to time, but never rich enough or continuous enough to pay for exploitation. Twelve years ago, the Buddigower deposits, 20 miles north of Ardlethan, were worked, and the yield at the surface was quite satisfactory. With depth, however, the lodes became too poor to work. Mr. Pittman, having knowledge of these deposits, is cautious about expressing an opinion as to the prospects of those at Ardlethan. It is a notable fact that the Ardlethan outcrops have been known for many years, and being in the vicinity of a fairly populous town, it is a wonder that their character should not have been recognized before now. The outcrops consist of boulders of remarkably rich ore, but they are incrustated with iron oxide and carbonate and so escaped notice. Mr. Pittman reports that these boulders have often been as much as one ton in weight and have assayed 40 to 50%

metallic tin. Geologically, the lodes are found in granite near the contact with Silurian slates and sandstones. A large number of claims have been pegged, and work done on them. One of the most interesting is the Carpathia property. Here there was an accumulation 20 ft. wide of ferruginous tinstone in large boulders and smaller pieces. At first it was supposed that this constituted a vein that would persist in depth, but, as Mr. Pittman points out, it was only a surface enrichment. About 34 tons was dispatched to the smelters, averaging 40% metal. After this loose material had been removed, and trenching and sinking done, the actual lode was found to be 12 ft. wide.



Wales has come from the northeastern end of the State, and has been obtained from placers. Lodes have been found from time to time, but never rich enough or continuous enough to pay for exploitation. Twelve years ago, the Buddigower deposits, 20 miles north of Ardlethan, were worked, and the yield at the surface was quite satisfactory. With depth, however, the lodes became too poor to work. Mr. Pittman, having knowledge of these deposits, is cautious about expressing an opinion as to the prospects of those at Ardlethan. It is a notable fact that the Ardlethan outcrops have been known for many years, and being in the vicinity of a fairly populous town, it is a wonder that their character should not have been recognized before now. The outcrops consist of boulders of remarkably rich ore, but they are incrustated with iron oxide and carbonate and so escaped notice. Mr. Pittman reports that these boulders have often been as much as one ton in weight and have assayed 40 to 50%

Samples were taken at 8 ft. below surface, and assayed at the Government laboratory. These showed that the average was 12½% metal, and that the portions nearest the walls were the richest. At other claims the lodes have not been so wide or rich. The information so far available points to the orebodies being lenticular, and here and there containing shoots of richer ore.

Progress in Gold-Silver Metallurgy.—The *Mining and Scientific Press* for January 4 contains Alfred James' annual review of the progress in the metallurgy of gold and silver. We extract from it some notes relating to practice in South Africa. The collecting tanks for sand appear to be on the way to general abolishment, following the example set by the Gold Fields. The results obtained by the Princess and the East Rand plants, with only the treatment vats without the preliminary collectors, warrant this departure. At the latter the best extraction is obtained

by any plant on the Rand. All new plants, such as that for the Geduld will probably be built on this modern system. Decantation, also, is dealt as a process to be adopted at new plants, which are all now designed for filtration. The introduction of these modern methods is not the only feature of Rand practice, for there is still steady progress on older lines, as is evidenced in the design and construction of the mill at the Roodepoort United Main Reef. Here it has been notably shown that heavy stamps and high duty can be combined with economy in design, power, and working cost. Mr. James praises the soundness of the judgment which has enabled S. H. Fariar, F. Bulkeley, and M. Torrente to avoid extravagance noticeable elsewhere and yet to include just those things (flag steel bins, almost vibrationless heavy stamps, tube-mills of large diameter and specially determined length with simple linings, and tailing wheels) which make it one of the most cheaply operated mills on the Rand. He asks why local engineers should put in power-eating centrifugal pumps with most costly monthly renewals (£60 per month or more), with uneven delivery of pulp to the spitzkasten, and with an awkward tendency to go wrong with coarsely crushed pulp, when tailing-wheels at less than £10 per month for repairs do all the work with a steady flowing discharge on even the coarsest crushed material. The Roodepoort mill crushes 20 tons per stamp per day, and does this readily with only one feeder for each battery. This mill is stated to operate for 14 kw-hr per ton for everything from breaker stations to clean-up and blacksmith shop, as against the 23 to 30 kw-hr stated to be usual in African practice. In other words, it crushes and beneficiates 1000 tons of ore per day with about 700 hp., and a peak load under 1000 hp. The mill consists of 100 stamps of 1900 lb., only 50 working. The tube-mills are 6 ft. in diameter and 16 ft. long. Stamping costs 11d per ton. Milling, including sorting, crushing, stamping, tube-milling, amalgamating, and retorting (everything up to the cyanide plant) costs 1s. 6d per ton. The Albu group who erected this mill are also responsible for many of the improvements in Rand practice, including the Denny brothers' abandonment of long (30 day) percolation of coarse sand particles, the introduction of tube-mills, and of the filtration of slime. Undoubtedly, up to the present the Roodepoort mill may be regarded as the best example of a modern mill on the Rand of the type general to the district, without air-agitation or slime-filtration. But this type of mill without air-agitation or slime-filtration is now moribund.

S. H. Pearce, at the latest Crown Reef mill, takes the precaution of a final air agitation for his slime prior to filtration in the Butters filter, which has produced so great a change in Rand methods. E. H. Johnson, at the East Rand, was one of the first to approve of filtration and the first to adopt continuous agitation in Pachuca. But the 'Doctor' of the Rand must be F. L. Bosqu; one almost fears to state how low the Bantjes recovery was before he took it in hand, or how great an improvement he has effected in City & Suburban results.

Recent plants in Africa have the tube mills set diagonally to the centre-line of the house, to economize space and to afford a more convenient belt drive. The expensive Citroen gear of the City Deep type, with its direct drive, has not been generally adopted. Belt-drives appear to be preferred for the majority of the new plants. Ribbed liners of the Osborne type, and liners made up of concrete blocks studded with steel projectors (old drill ends) are displacing slinx. They are stated to have the advantage of longer life and of

collecting amalgam scoured off the plates. Indeed, the re-lining of a tube-mill is now found to add as much as 400 or 500 oz. to the output by the recovery of the amalgam collected by the old liner. Authoritative tests will still be required on the loss in efficiency caused by the employment of ore in place of selected pebbles.

In writing of classification of pulp, Mr. James remarks that W. A. Caldecott's cone and table, worked together, make probably one of the best products for cyaniding ever fed into a vat. In Africa, until recently, full advantage has not been taken of this fact, and even at the Simmer the product is fed with cyanide solution into collecting-vats and transferred into leaching-vats. It is obvious that with such a product, collecting-tanks are an unnecessary expense, and H. A. White, at the Princess mine, has shown how good are the results obtainable by direct treatment of the product. But cones are troublesome; they require continuous attention; and thus even the Caldecott table does not excite an enthusiasm for cones in comparison with the automatic simplicity and perfection of the continuous work of the Dorr classifier. But a further advantage of the Caldecott table is the dryness of the product under 15% moisture—which enables the balance of solutions (15 to 20%) to be maintained with something in hand. Classifiers of the Dorr and Hoyle types just exceed the point, say 20 to 25%, and make draining the vats or some intermediate step necessary. Argall claims with his Ovoca classifier, working so successfully at Stratton's Independence, to give a drier product as a result of the compression of the pulp between his two spirals and to come just within the point, say 18 to 20%, and this type has accordingly been adopted in the most recent design of a large mill for Queensland.

Continuous Decantation.—In our last issue we gave a précis of articles published in the *Mining and Scientific Press* and the *Engineering and Mining Journal*, discussing the merits of continuous decantation of slime for the extraction of gold from ores, as a substitute for the vacuum filter. It was argued that the adoption of the decantation method, though advantageous in obviating the use of a process now granted a monopoly in the United States, constituted in effect a reversion to an old type. The Dorr Cyanide Machinery Co. is erecting a number of plants on the continuous decantation system. Its official circulars wisely describe the limitations of the process, and show how, according to circumstances, the decantation system can be used either by itself or in conjunction with the filter. In *Metallurgical and Chemical Engineering* for January, H. C. Parmelee describes the new plant erected by the Dorr company at the Suffolk property, belonging to the Ophir Gold Mines company in the San Juan district of Colorado. This mine yielded profits from high-grade ore for some years, but recently the company erected plant, designed by J. N. V. Dorr, for treating the low-grade ore left behind, averaging \$5.00 per ton. This ore is soft and easily crushed, and it contains no constituents that act against cyanide. Thus the consumption of cyanide is only 0.1 lb. per ton of ore, and that of lime, as protective alkali, 1 lb. per ton. Much of the gold is immediately soluble in the cyanide solution, and is dissolved while the ore is in the stamps and Hardinge mill. But a constant amount per ton, about \$2.40, requires much longer time for extraction, and in practice 36 hours agitation is given, the final tailing averaging 20 cents per ton. The accompanying flow-sheet shows the process of treatment, and the figures are based on a gold content of \$5.00 per ton. The stamps

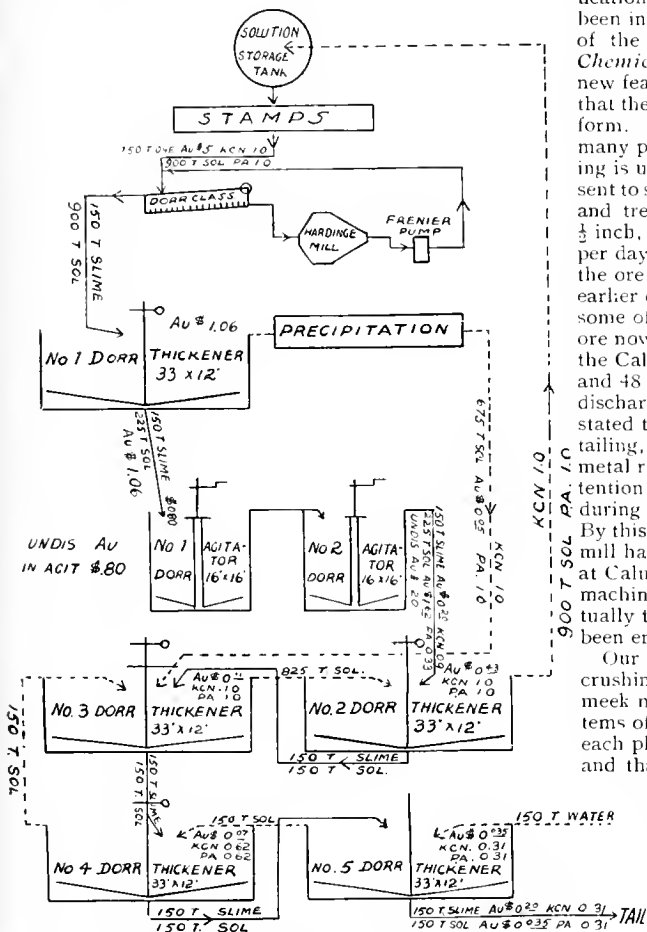
and Hardinge mill reduce the ore to 200-mesh, and the cyanide solution used in them dissolves a large amount of gold. The pulp is sent to a Dorr thickener, the over-flow from which is sent to precipitation-boxes, while the thickened pulp goes to Dorr agitators. The subsequent sequence of washings and thickenings is made clear in the diagram. It should be noted that the barren solution is added in the third of the five thickeners, a method based on calculations to give the lowest combined losses of cyanide and gold. Normally the plan would be to send the barren solution to the last thickener.

Parmelee's flow-sheet was erected. No doubt additional details will be forthcoming before long. An advantage of the new agitator is that the accumulation of solids at the bottom, a drawback of the inverted-cone design, is obviated. Another is that it is not necessary to have so tall a vat as the Pachuca.

Concentration at Lake Superior Copper Mines.—The ore-dressing practice in the Lake Superior copper district was described by T. A. Rickard in his book on the subject, published in 1905, and the methods then detailed have continued as the standard at most of the mines. During the last year or two important modifications have been made, and additional plant has been introduced for the re-grinding and re-treatment of the tailing. An article in *Metallurgical and Chemical Engineering* for December describes the new features recently adopted. It is generally known that the Lake Superior ore contains copper in metallic form. Some masses of copper weigh many tons, and many pieces weighing pounds are found. Hand-picking is universally adopted, and afterwards the ore is sent to steam-stamps. Subsequently the pulp is jigged and treated on tables. The stamps crush to about $\frac{1}{2}$ inch, and the capacity of each is as much as 600 tons per day. At the present time the average content of the ore raised is from 17 to 25 lb. of metal per ton. In earlier days the content was far higher, and probably some of the old tailing contains as much metal as the ore now being mined. In 1909, the premier producer, the Calumet & Hecla, decided to re-grind the tailing, and 48 Chilean mills were erected for the purpose, the discharge being treated on 200 Wilfley tables. It is stated that the recovery was 5 lb. of copper per ton of tailing, and that the cost was 5 cents per pound of metal recovered. As this plant was so successful, attention was turned to the stacks of tailing accumulated during many years, and aggregating 40 million tons. By this time, the tube-mill and the Hardinge conical mill had proved their capabilities, and the authorities at Calumet & Hecla tested these types of re-grinding machines in competition with the Chilean mills. Eventually the Hardinge mill was adopted, and plant has been erected with a capacity of 3000 tons per day.

Our contemporary proceeds to describe the new crushing and concentrating plant erected for the Ahmeek mine. In order to test the old and modern systems of concentration, two plants were built, one on each plan, and finally the old method was abandoned, and that part of the plant reconstructed on the same lines as the other. According to the old plan, the ore before and after crushing was treated hydraulically for the purpose of catching the larger pieces of copper. In the modern practice, the new type of Woodbury bull-jigs are employed instead, as much better separation is effected. A number of other improvements have been introduced, the alterations in connection with which need not be here enumerated. We give in the following paragraph an outline of the modern practice.

The discharge from the stamps is sized to $\frac{1}{4}$ in., the oversize being treated in the bull-jigs mentioned above. The undersize goes to Woodbury classifying jigs, each containing a classifying compartment and three jigging compartments. The classifier compartment has a 10-mesh screen and the jigs a 12-mesh screen. The classifier removes the slime, and produces a copper concentrate, the remaining sand flowing to the jigs. The first jig compartment produces copper, and the second and third deliver a middling through an adjustable opening which permits only the bottom portion to pass out. This middling is re-



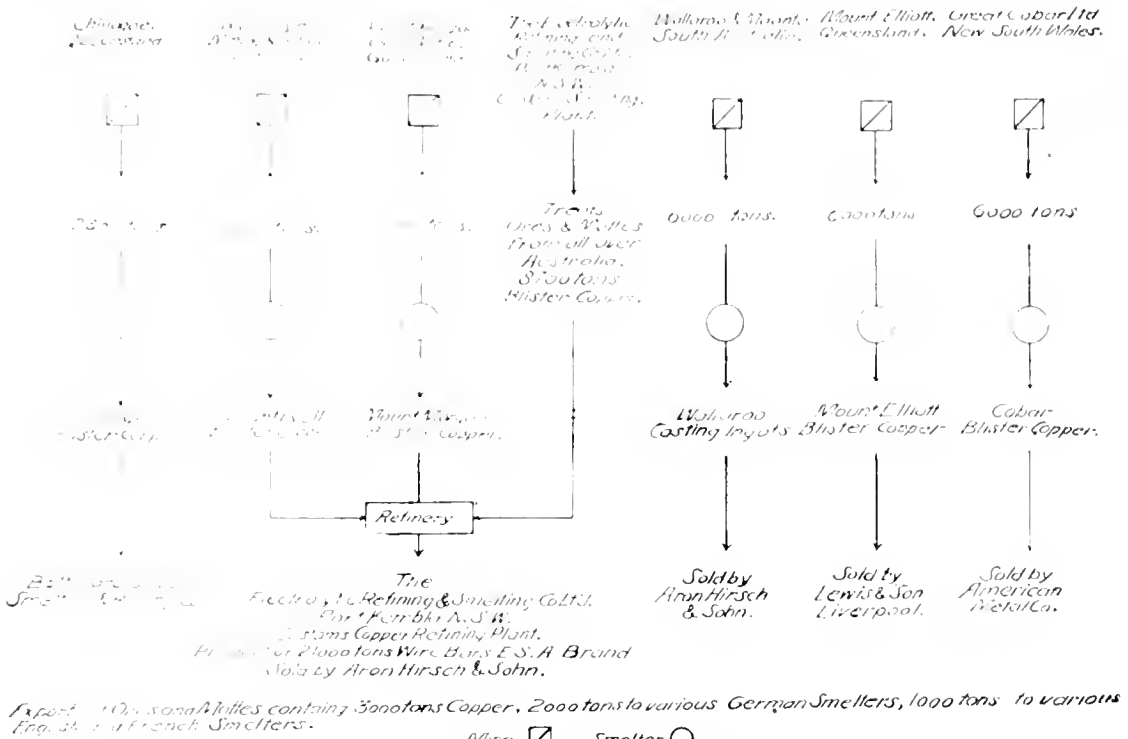
FLOW-SHEET OF OPHIR CYANIDE PLANT.

In the above description, mention is made of the Dorr agitator. Nothing has as yet been published relating to the new machine, though announcements were made about it in several technical papers when it was installed at the Hollinger mine at Porcupine. Mr. Parmelee, in his article, does not give a drawing, but he states that the agitator measures 16 ft. diameter by 16 ft. in height, and that it is flat-bottomed. Slowly-revolving blades carry the pulp towards the middle, where it is elevated by the air-lift. Thus the plant is a combination of air-lift circulation and mechanical agitation. We understand that improvements have been made since the plant shown in Mr.

ground in a Hardinge mill. The tailing is discharged as waste, and the hutch material is sent together with the similar product from the bull jig, and classified for treatment in Hodge finishing jigs. The tailing from the finishing jigs is treated on Wilfleys, the middling from which is treated on another Wilfley. The middling and tailing from the latter are re-ground in another Hardinge mill. The discharge from the two Hardinge mills goes to other Wilfleys, the middling from which is returned to the table that delivers its middling to the second Hardinge. The slime from the Woodbury classifier is treated on Wilfleys, the middling from which is re-treated on another one. It is stated that by this new arrangement the recovery is increased and the cost decreased.

converters, has been working since August, and that the contract for the sale of blister copper is in the hands of Brandeis, Goldschmidt, & Co., London metal-brokers acting for German buyers. Before the new plant was at work, the matte produced was sent to the Mount Elliott smelter.

Brochantite at Chuquicamata.—In our December issue we made brief mention of the fact that the Guggenheims had acquired a deposit of brochantite or basic sulphate of copper at Chuquicamata, Chile. Further information relating to this deposit is published by M. M. Thompson and K. A. McGovern in the *Engineering and Mining Journal* for January 18. The deposit is of low grade, and has been known for centuries, being worked from time to time by the na-



THE MARKETING OF AUSTRALIAN COPPER.

(In addition to the above the Hampden Cloncurry has recently commenced the production of blister copper).

Australian Copper.—In his annual review of the progress in the metallurgy of copper, published in the *Mining and Scientific Press* for January 4, Thomas T. Read gives a diagrammatic representation of the origin and destination of Australian copper products. We reproduce this here-with, and pass along Mr. Read's acknowledgment of his indebtedness for the chart to Benjamin Magnus, who was for some time manager of the Port Kembla refinery, owned by the Electrolytic Refining & Smelting Company, and more recently appointed to the management of the Mount Morgan metallurgical department. Since the chart was prepared, another smelter has joined the list of producers of blister copper, namely, the Hampden Cloncurry in North Queensland. In our section devoted to 'Company Reports' we mention that the new smelting plant, consisting of two blast-furnaces and two

converters. The predominating mineral was supposed to be atacamite, the oxychloride, but deeper drilling shows that brochantite occurs in much greater quantities. The property is in the northern part of Chile, 262 kilometres from Antofagasta, in latitude 22° 30' south, east of the nitrate fields, in the rainless and barren foot-hills of the Andes, and at an altitude of from 7500 to 9000 ft. Climatic conditions are trying, for though there is no rain, the wind-storms are often sufficiently strong to make the stoppage of work unavoidable. Also the daily temperature varies within wide limits, sometimes as much as 80 F. The mineralized zone is about 2 miles long, and up to 1/2 mile wide. It runs nearly north and south along a ridge that rises abruptly from the plain. The brochantite occurs in crevices in a highly-weathered granite. In addition to brochantite and atacamite, there are also found

smaller proportions of chalcantite, cuprite, and chalcocite. No satisfactory theory has been advanced as to the origin of the minerals. The country-rock is much faulted and has undergone considerable dynamic disturbance during comparatively recent geologic time. The ore however does not appear to bear any direct relation to the fault-seams thus produced, as the gangue material is mostly powdery yellow and red ferruginous clay, practically free from copper. The ore may be taken to be a general impregnation of the entire country-rock. The copper content varies between wide limits, and there is little uniformity in any part of the deposit, so that ordinary underground methods of mining are impossible. Extensive drilling operations are now being undertaken, and when the deposit has been thoroughly prospected in this way, preparations will be made for mining by steam-shovel. As the copper minerals are of approximately the same specific gravity, it will not be possible to concentrate, and wholesale leaching will be adopted. Owing to the corrosive nature of the brochantite, the drilling operations have encountered unusual difficulties.

CURRENT LITERATURE.

Mine Surveying.—At the January meeting of the Institution of Mining and Metallurgy, L. H. Cooke presented papers on improvements in mine theodolites.

Progress in Ore Dressing.—The *Mining and Scientific Press* for January 4 and 11 contains a review of progress in ore dressing by Henry S. Munroe.

Gold-Dredging.—The *Mining and Scientific Press* for January 4 contains articles by Charles Janin on the progress of gold-dredging in California, Alaska, Idaho, Montana, and other states.

Yuanmi Gold Mine.—The *Monthly Journal* of the Chamber of Mines of Western Australia for November, contains an article by W. R. Degenhardt and W. B. Blyth on the slime plant at the Yuanmi gold mine in Western Australia.

Liberty Bell.—In the *Engineering and Mining Journal* for January 4, H. E. Megraw describes the cyanide process as used at the Liberty Bell, at Telluride, Colorado.

Parkes Process in United States.—The December *Bulletin* of the American Institute of Mining Engineers contains a paper by E. F. Eurich tracing the history of the development in the United States of the Parkes process for desilverizing lead by means of zinc.

Secondary Enrichment.—In the *Mining and Scientific Press* for January 4, C. F. Tolman gives the first part of a general review of the phenomena of secondary enrichment of ores.

Tin in the Transvaal.—The *South African Mining Journal* for December 14 and 21 contains articles on the geology of the tin deposits of the northern Transvaal. These are founded on the principles relating to the occurrence of tin ores reviewed by H. G. Ferguson and A. M. Bateman in their article appearing in *Economic Geology* in May last.

Coal Mining in India.—The *Iron & Coal Trades Review* for January 3 and 10 reprints a paper, read by J. R. R. Wilson before the National Association of Colliery Managers, on the coal deposits of India and the methods of working them.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

De Re Metallica. By Georgius Agricola. Translated from the first Latin edition of 1556 by Herbert Clark Hoover and Lou Henry Hoover. Folio, 637 pages, illustrated. Published by *The Mining Magazine*. Price 21s. net.

This magnificent volume has been expected for several months. It is the famous old book on mining published in 1556 by George Bauer, better known by his Latinized name of Georgius Agricola. The volume is a folio bound in the white vellum or sheep-skin in which books were clothed during the early days of the printer's art. The pages are of the same size as the original. The type is as nearly like that of the first text as a modern font allows. The illustrations are in facsimile of the originals. The paper simulates that of an ancient edition. The printing has been done, and remarkably well, by Albert Frost & Sons, Rugby. As the Latin language is more compact than English, a translation requires about 25% more space. Therefore the type is smaller than the original. Moreover, the book is remarkable for a scholarly appendix and a useful index, besides a copious addition of foot-notes. These if collected by themselves would fill an ordinary octavo volume. They constitute an important addition to the translation and represent an amount of painstaking research highly creditable to Mr. H. C. Hoover, who is entirely responsible for them. Some of them are essays summarizing the knowledge extant in Agricola's time concerning subjects of fundamental interest. For instance, that on alchemy on pages xxvii to xxx; on the mines of Laurium, pages 27 to 29; on ore deposits, on pages 43 to 53; on mining law, on pages 82 to 86; on the nomenclature of minerals, on pages 108 to 115; and so forth. Indeed, the historical notes on various branches of the art of mining as understood up to the sixteenth century are not only interesting in themselves but serve to measure the sincerity with which this "labour of love," as the translators like to call it, has been performed. In the preface they state some of the difficulties that they faced, and overcame. They explain the importance of the old classic. They tell the purpose of their effort. In an introduction, the biography of Georgius Agricola is given, with a view to enabling the reader to gain a proper perspective of the author's status in time and place. Then follows a scholarly appreciation of Agricola's attainments and of his position in the development of scientific thought. Finally, the introduction ends with an account of the various translations and editions of DE RE METALLICA. All this preliminary portion, occupying 17 pages, is deeply interesting. It is an overture to the opera; it attunes the reader's mind to the venerable volume which now for the first time he can read comfortably in a familiar language.

In his dedication to the dukes of Saxony, Agricola explains to these princes how dignified is the art of mining. He tells them that "we learn from the history of nearly all ages that very many men have been made rich by the mines, and the fortunes of many kings have been amplified thereby." He describes his own reading of previous authors on the subject, notably Pliny, and emphasizes the propriety of making suitable acknowledgment, adding that "no one should escape just condemnation who fails to award due recognition to persons whose writings he uses, even very slightly." We commend this rule of the game to technical writers of the present day, to whom various shades of plagiarism are habitual. Then follows an exposure of the alchemists, not without its bearing on the radium-hunters of Cornwall. In order to aid

and descriptions, and not to be misunderstood, he tells the reader that he has spent a good deal of money in having illustrations to prepare drawings under his supervision, so that posterity may find no difficulty in comprehending the shape of the things concerning which he writes. He adds: "I have omitted all those things which I have not myself seen, or have not read of or heard of from persons upon whom I can rely."

In his preface he gives a synopsis of his treatise on mining. "We cannot do better than give it in his own words." The first book (or chapter) contains the arguments which may be used against this art, and against metals and the mines, and what can be said in their favour. The second book describes the miner, and branches into a discourse on the finding of veins. The third book deals with veins and stringers, and seams in the rocks. The fourth book explains the method of delimiting veins, and also describes the functions of the mining officials. The fifth book describes the digging of ore and the surveyor's art. The sixth book describes the miners' tools and machines. The seventh book is on the assaying of ore. The eighth book lays down the rules for the work of roasting, crushing, and washing the ore. The ninth book explains the methods of smelting ores. The tenth book instructs those who are studious of the metallic arts in the work of separating silver from gold, and lead from gold and silver. The eleventh book shows the way of separating silver from copper. The twelfth book gives us rules for manufacturing salt, soda, alum, vitriol, sulphur, bitumen, and glass.

An appreciation of the translation will be found in our editorial pages. It remains to say that the preparation and publication of this translation has cost the translators four or five times the price at which the book is sold. No idea of money-making was involved in the purpose of the translators. The expectation was, we believe, to do something useful and to win an honourable fame. In order to protect the translators and the publishers against the obvious temptation, to enterprising persons, of buying the book as a profitable speculation, it has been found necessary to number each volume and to record the name of each purchaser. The reason for these precautions will readily be apparent to those who obtain a copy of the book and realize how nominal is the price, which was fixed by the translators, not the publishers, with a view to giving their work a maximum of scope and utility. T. A. R.

The Petrology of the Sedimentary Rocks. By F. H. Hatch and R. H. Rastall. Cloth, octavo, 420 pages, illustrated. London: George Allen & Co. Price 7s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

Dr. Hatch is too well known to require introduction. Mr. Rastall, the joint author, is demonstrator in geology in the Cambridge University, under F. Mc K. Hughes, and has already won fame as part author with Lake of the 'Text book of Geology.' The best tendencies in technical literature nowadays are toward specialization, and this book forms a good example. It deals with a small section of economic geology that is often neglected. Books on petrology usually devote by far the greater share of attention to the igneous rocks, and the study of their origin. The petrological study of the sedimentary rocks is not so often a favourite with authors. The present book treats this subject in detail. The first section, relating to the primary sedimentaries, is not of special interest, for it covers ground that is fairly elementary, but the second section, dealing with metamorphosed sedimentaries and

secondary sedimentaries, and containing a discussion of the constituent minerals and the parts played by them, is of distinct interest, and helpful to the student in tracing the history of the rocks. A valuable feature of the book is an appendix by F. Crook, whose 100 pages treat of the systematic examination of loose detrital sediments.

Mineralogy. By Alexander Hamilton Phillips. Cloth, octavo, 700 pages, with many illustrations. New York: The Macmillan Co.; London: Macmillan & Co. Price 10s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

There are many books on mineralogy, and the professors find it hard work to invent new ways of presenting their subject. Of all those recently published, that by Alexander Hamilton Phillips, professor in Princeton University, seems to have the best claim to existence, for it covers more ground and more branches of the study of minerals than anything at present extant, and it presents the subject concisely and clearly without too much detail. The first 200 pages deal with crystallography and the optical properties of crystals. The second section is devoted to descriptive mineralogy, and the third to determinative mineralogy. In all three sections the author's own experience has introduced simplifications of method that tend to help the reader and student. For instance, the determinative tables and chemical tests used in blow-pipe work are concise and remarkably complete, and no difficult or complicated tests are given. The table for the identification of minerals by their physical properties is also deserving of praise. The illustrative drawings are all new, and many photographs, of varying merit, are given of specimens in the Princeton museum. The chapter on the origin of minerals is illuminating. The book is such a useful one that we hope the publishers will issue an edition in more portable form. The weightiness of the present edition will militate against its purchase by those who do much travelling. It is not easily packed in the gripsack.

Land and Mining Surveying. By G. L. Leston. Cloth, octavo, 370 pages, illustrated. London: Crosby Lockwood & Son. Price 6s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This book has been prepared chiefly for the use of working miners, who have limited opportunities for varied experience in the practice of surveying above and below ground, and who are not sufficiently versed in general principles to make the ordinary text-books easy to follow. The methods of manipulating the chief instruments are given in great detail, and many of the instructions relate to items usually learnt in everyday practice. Probably the book will for this reason be acceptable by workmen connected especially with coal-mining.

Portuguese Self-taught; Second edition, revised. By E. da Cunha. Small octavo, 120 pages. London: E. Marlborough & Co. Cloth, 2s. 6d.; paper covers 2s. For sale at the Technical Bookshop of *The Mining Magazine*.

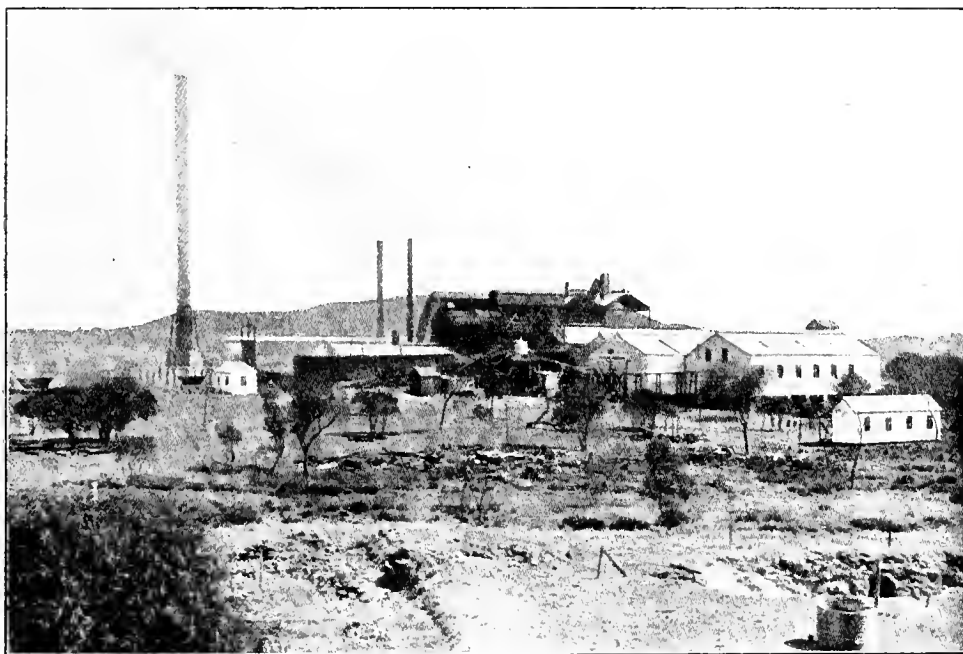
This is one of Marlborough's well-known series which have for some years proved acceptable to travellers in foreign countries. Instructions as to the alphabet and pronunciation are followed by a short outline of grammar. Seventy pages are devoted to a vocabulary, English into Portuguese, and forty pages to conversational phrases adapted to the traveller's requirements. Particulars are also given of money, weights, and measures.

COMPANY REPORTS

Hampden Cloncurry Copper Mines.—This company was formed in Melbourne by the Baillieu group in the year 1906, for the purpose of acquiring the Hampden and Duchess copper properties in the Cloncurry district, North Queensland. More recently the Trekelano and Mascotte properties have been purchased, and three months ago negotiations for the MacGregor claims were begun. In 1909 the company was reconstructed and additional capital subscribed. Smelting was started in April 1911, and the matte was sold to the Mount Elliott company. The report now published, covering the year ended August 31 last, shows that attention has been centred on the completion of the smelting plant. The plant was put in com-

to reserve for depreciation, and the balance carried forward. The Government railway has been completed, connecting the Duchess mine with the main line between Mount Elliott, Hampden, and Cloncurry. The financial position of the company has been greatly strengthened by the recent issue of 50,000 new £1 shares at 50s. each, placed by Lionel Robinson, Clark & Co., who have an option on a further 50,000 at 56s. per share. The purchase of the MacGregor properties has not been definitely completed, though it will probably be within a short time.

Associated Northern Blocks.—This company was formed in 1899 to acquire the Iron Duke and adjoining leases at the northern end of the 'Golden Mile' at Kalgoorlie, Western Australia. The control is in the same hands as the Associated Gold Mines, and until



THE HAMPDEN CLONCURRY SMELTER.

mission on July 16. It contains two blast-furnaces, one measuring 84 by 42 in., and the other 168 by 42 in.; and two converters. The blister copper is sold to Brandeis, Goldschmidt & Co. During the run from July 16 to August 31, the smelters treated 2580 tons of Hampden ore, averaging 8% copper, 2906 tons of Duchess ore, averaging 18% copper, and 79 tons of purchased ore. The resulting blister and matte contained 670 tons copper, 268 oz. gold, and 7074 oz. silver. Hardly any development has been done lately owing to the stress of work connected with the completion of the smelter. On August 31, the ore reserve was estimated by the manager, Erle Huntley, as follows: Hampden 88,000 tons, averaging 7¾% copper; Duchess 80,000 tons, averaging 16%, and 56,000 tons averaging 5%; Trekelano 12,000 tons, averaging 14%; Mascotte 2500 tons, averaging 16%. The accounts for the year show an income of £114,733, and a profit of £17,217. Out of the latter, £5072 is placed

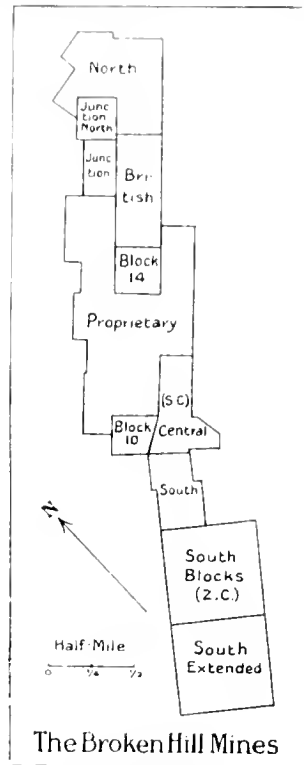
two years ago the management of the two properties was in the hands of George M. Roberts. Since then the Associated Gold Mines has been managed by Duncan F. McAulay, while Mr. Roberts has devoted his sole attention to the Northern Blocks. As we recorded a year ago, the Northern Blocks mine is practically exhausted, and during the year ended September 30 last, covered by the report now issued, it has been in the hands of tributors. During this time 20,476 tons of ore was raised, of which 14,223 tons was mined by the tributors. This, together with 7292 tons purchased, was treated in the mill. The yield was £15,733 from the company's ore, £49,901 from tributors' ore, and £33,043 from the purchased ore. The royalty on tributors' ore was £11,074, and the charges for treatment were £13,257. The customs charges on purchased ore were £8294. The chief work of the company, however, has been centred on the Victorious leases at Ora Banda, where the developments have

been sufficiently satisfactory to warrant the erection of a metallurgical plant with a capacity of 300 tons per day. The first section of the mill started in September, and during the short time until the 30th of the month, 5,007 tons was treated for a yield of £5316. The orebodies are irregular, as is also the content. The reserve above the 3rd level is calculated at 200,000 long tons averaging 20s. per ton. The most recent developments in the 4th level have disclosed ore of higher value. The company also owns the El Refugio group of silver gold mines at Salinas, Zacatecas, Mexico, which are being developed by W. E. Simpson. Unfortunately the unrest in Mexico has prevented any work being done there recently, and Mr. Simpson recommends the leasing of the property to local people who are prepared to erect the necessary treatment plant. The accounts show an income of £103,993 from the sale of gold, of which £50,317 was paid to tributors and to the sellers of the purchased ore. The net profit for the year was £16,900, which was carried forward.

Broken Hill Block 14.—The mine belonging to this company is situated between those of the Broken Hill Proprietary and the British Broken Hill. During recent years operations were confined to the removal of carbonate ore from the upper levels, as the sulphides were of too low a grade to pay. Five years ago the reserve of sulphide was reported at 220,000 tons, averaging 12% lead, 9% zinc, and 8½ oz. silver. Six months ago we mentioned that experiments were being conducted by the Zinc Corporation with the view of the latter company purchasing the output of sulphides. This proposition has now been abandoned, and a contract has been made instead with the Junction North company. The report for the six months ended September 30 last shows that a commencement was made at the end of July of shipments of sulphide ore to the Junction North plant, and that up to the end of the period under review, 2173 tons, averaging 15.1% lead, 11% zinc, and 11.9 oz. silver had been delivered. This came from the 200, 300, 400, and 500-ft. levels. More would have been mined had it not been for the scarcity of labour. A year ago a contract was made with the Junction North for the sale of accumulated slime. During the last five years the shipments of carbonate ore from the upper levels have been continued, and for the past six months 12,484 tons, averaging 28.63% lead and 16 oz. silver, was sold to the Broken Hill Proprietary. H. Voss Smith, the manager, states that, though no measurements can be taken, the probability is that the mine will yield a steady supply of carbonate for some time yet. The income for the half-year was £51,799 from ore and £4850 from accumulated slime. After provision for taxes and depreciation, the divisible profit was £29,022, out of which £1500 was paid as interest on preference shares, being 5% on £30,000, and £10,000 as dividend on the ordinary shares, being 4% on £125,000. The sum of £10,000 has been placed to reserve against any fall in the price of metals.

Broken Hill Block 10.—A year ago we recorded that the lead concentration plant at the mine belonging to this company was being reconstructed on lines recommended by George Weir, the manager of the North Broken Hill mine. At the same time we mentioned that O. B. Ward, the new manager, had made a reduction in the estimate of ore reserves and tailing dumps. For the six months following, the only revenue of the company came from the sale of zinc tailing sold to the Amalgamated Zinc (De Bavay's). The report for the half-year ended September 30 shows that the new mill started in March, and that during

the period under review, 47,951 tons of ore, averaging 12.6% lead, 14.53% zinc, and 11.95 oz. silver, was treated, yielding 6361 tons of lead concentrate, averaging 65% lead, 6.54% zinc, and 37.98 oz. silver. The extraction of lead was 68.42% and of silver 42.17%, as compared with 65.45% and 37.36% respectively during the corresponding period the year before with the old plant. The report states that 35,245 tons of current tailing, and 22,360 tons of dump tailing were dispatched during the half year, and also 10,506 tons of slime from the new mill. As regards development at the mine, the manager reports that at the 1815-ft. or lowest level the lode so far explored is of low grade. At the 1715 and 1615-ft. levels, the ore has been proved to average 9% lead, 9% zinc, and 8 oz. silver as far as present developments go, but the width of



the lode is much smaller than in the upper levels. The new orebody discovered at the boundary of the Central mine and the Block 10 mine promises to be of great importance. The development of this orebody during the past half-year has been done entirely from the Central mine, by courtesy of the owners, the Sulphide Corporation. A drift 93 ft. long at the 500-ft. level, in the Block 10 property, contained ore averaging 14.1% lead, 8.9% zinc, and 3.7 oz. silver; and cross-cuts proved the lode to be 19 ft. wide. The accounts for the half-year showed receipts £80,168 from the sale of concentrate, and £10,645 from the sale of tailing and slime. The profit, after allowance for taxes and depreciation, was £36,049. Out of this, £10,000 was paid as dividend, being 2s. per £10 share on a capital of £1,000,000, and £20,000 was placed to reserve to provide for the possible fall in the price of metals.

Mount Lyell Mining & Railway.—The report of this Tasmanian copper company now issued covers the half-year ended September 30 last. It shows that the mines had recovered from the effect of the strike of a year ago, and in reading it we have to remember that since the close of the period the disastrous fire has caused a stoppage of operations. During the period, 74,724 tons from below and 21,523 tons from the open-cut were raised from the Mount Lyell, and 58,913 tons from the North Lyell. The yield in the furnaces

the current half-year's produce, 2128 tons was sold at an average of £81 per ton, leaving 996 tons still on hand. The accounts show an income of £309,937 and a divisible profit of £106,749. Of this, £75,000 has been distributed as dividend, being 1s. 3d. per £1 share. In order to provide hydro-electric power, an installation is being erected at Lake Margaret, and in order to provide the funds, 100,000 new shares were offered to shareholders at 25s. per share. Of these 86,739 have been subscribed. The chemical and



was 3161 tons of blister copper, containing 3124 tons copper, 213,285 oz. silver, and 4316 oz. gold. The ore reserve at the former was calculated at 2,361,182 tons averaging 0.532% copper, 1.96 oz. silver, and 0.54 dwt. gold; and at the latter, 1,083,752 tons averaging 6% copper, 1.33 oz. silver, and 0.1 dwt. gold. An important step was completed during the half-year by the purchase for £18,176 of the Lyell Comstock property, which adjoins the North Lyell and contains the continuation on the dip of the North Lyell lode. On March 31, there was 1172 tons of unsold copper on hand. This has since been sold for £78 per ton. Of

superphosphate business of the company is thriving, all three works, at Yarraville, Port Adelaide, and Fremantle, in the states of Victoria, South Australia, and Western Australia, respectively, being kept fully employed.

Tasmania Gold.—This company was formed in 1903 by John Taylor & Sons to acquire gold mines near Launceston, Tasmania, that had been previously worked by a local company. These mines had been successful until the great increase in the flow of water at depth made it necessary to suspend operations. On flotation in London large sums of money were provid-

ed for the erection of pumps and for the continuation of development work on an extended scale. In spite of the enormous capacity of the pumps, water troubles have recurred, and in addition the grade of the ore has been lower than expected. It was necessary to reconstruct in 1910, when the capital was reduced from £500,000 to £250,000 by writing down the 74 share to 10s., and issuing the new shares with a liability of 2s. 6d. In this way £62,500 additional capital was raised. The report for the year ended September 30 last shows that, though no profit was made, the developments on the 1500-ft. or lowest level have disclosed much ore of higher grade, so that the prospects have distinctly improved. During the year 51,839 tons of ore was raised and milled; 11,116 oz. gold was recovered by amalgamation in the stamps, 8931 oz. in the grinding plant, 572 oz. by cyaniding, and 890 oz. in slags, old plates, etc. The income was £90,806 and the total expenditure £94,972, leaving a loss of £4165. C. F. Heathcote, the superintendent, reports that the results on the 1370-ft. level were disappointing, but that those on the 1500 ft. level are encouraging. The level east from the cross-cut had been driven 296 ft. At 180 ft. the lode branched on the hanging-wall and the branch was followed for 171 ft. The main lode varied in width from 2½ to 7 ft., and the average content from 13 to 45 dwt.; while the branch vein varied from 1½ to 4 ft. in width and from 12 to 72 dwt. in content. It is intended to continue sinking, not by any of the shafts, but on the dip from the 1500-ft. level, owing to the lode being in ground that is less wet. When 250 ft. has been sunk in this way a pumping station will be excavated. If the country round the shafts is dried thereby, as is expected, further sinking of the present shafts will be undertaken. The new installation of electric pumps is expected to cost £20,000. The funds would be provided out of the uncalled capital, 1s. 6d. per share, totalling £37,500.

Rhodesia Broken Hill Development.—In our issue of August last we gave particulars of the group of mining companies under the general control of the Northern Copper (B.S.A.) and the Rhodesia Copper companies. The Rhodesia Broken Hill is one of this group, and it was formed in 1904 to acquire lead-zinc ore deposits in Northwestern Rhodesia, 374 miles north of the Victoria Falls. The deposits are extensive, but the commercial beneficiation of the ore is so far an unsolved problem, owing to most of the ore so far exposed being oxidized. The report for the year ended August 31 last shows that experimental work has been continued on both classes of ore, that is, in which lead and zinc predominate respectively. It has not been found possible so far to produce a concentrate that would stand the cost of freight to Europe, and any complete smelting or treatment plant erected on the spot would involve a greater initial expenditure than the board consider warranted. At present, investigations are being made with a view of obtaining a lead concentrate sufficiently low in zinc to enable it to be treated locally in an ordinary lead furnace. The capital of the company is £156,253, of which £14,241 was issued recently to option holders.

Bwana M'Kubwa Copper.—This company also belongs to the Northern Copper (B.S.A.) group mentioned in the preceding paragraph. It was formed in 1910 to acquire a large copper deposit to the north of the Rhodesia Broken Hill, and close to the border of the Congo State. Above the 350 ft. level, 120,000 tons of oxidized ore averaging 14% copper, and 700,000 tons of lower-grade ore averaging 5%, have been proved. The 450-ft. level is in sulphide ore, which averages 3 ft. wide and 5% in content, though suffi-

cient development has not been done to warrant a close estimate of its extent. The beneficiation of the oxidized ore is not a simple matter, owing to scarcity of fuel and flux, as well as the high cost of freight. A concentrating plant has been supplied by the Wilfley company with a capacity of 75 tons per day. This is to treat the high-grade oxidized ore. An experimental plant for leaching and electro-deposition was erected in London by Siemens & Halske, and trials were made by the company's metallurgist, T. Burns McGhie, with satisfactory results; but before a large plant is ordered Mr. McGhie is investigating the economic situation on the spot, in collaboration with James Cook, the general manager. The issued capital of the company is £445,770.

Selukwe Columbia Gold Mine. This company was formed in 1900 by the Rhodesian Exploration & Development Co. to acquire a gold mine in the Gwelo district of Southern Rhodesia. The operations were not successful and the mine and mill were closed. In 1908 the company was resuscitated, and additional capital raised. Milling was resumed in May 1909. During the past year the control has passed to the Consolidated Gold Fields of South Africa. The report now issued covers the year ended June 30 last and shows that the development has been unsatisfactory owing to faulting in the lowest levels. It has been deemed advisable to acquire additional adjoining properties, and the Wonderland and Chimborazo have been purchased. For this purpose 100,000 new shares of 5s. each have been created; 35,000 of these and £10,225 in cash are to be paid for the new properties; 20,000 shares and £5000 cash are being allocated for the probable purchase of another property, the Danga. The remaining 45,000 of the new shares will be held in reserve. During the year under review, 29,929 tons of ore averaging 11½ dwt. was milled, yielding by amalgamation and cyaniding gold worth £60,703. The metallurgical plant consists of Chilean mill and Forwood-Down pans, and sand and slime plant. The working cost was £54,827, and after the payment of London expenses and allowance for depreciation, the net profit was returned at £1397.

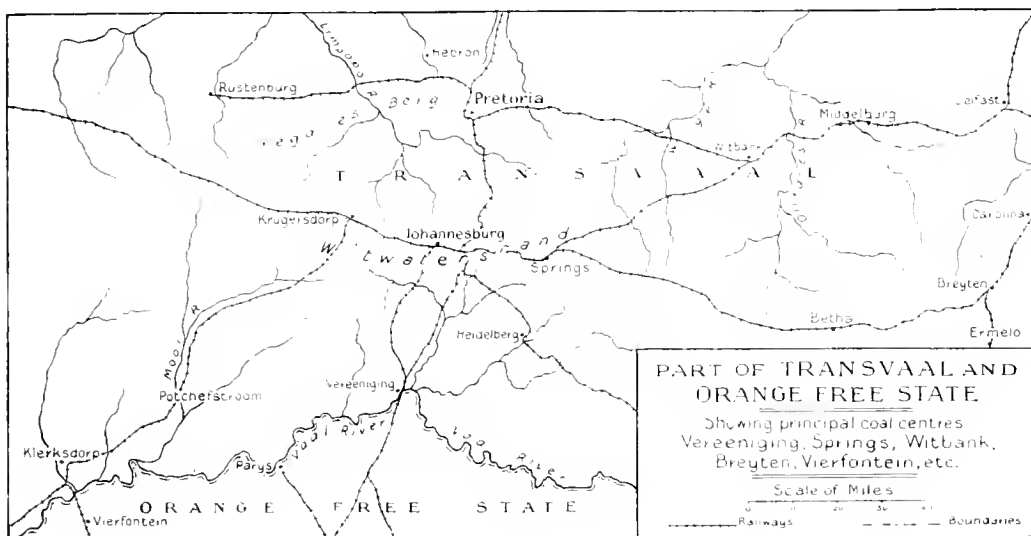
Hay Gold Mining.—This company belongs to the Weil group and was formed in 1910 to acquire a gold mine of that name, and its equipment, situated in the Mazoe district of Southern Rhodesia. The plant now contains 10 stamps, 1 tube-mill, and vacuum filter. Unfortunately the ore deposit has been a disappointment, and on November 9 last, the mill was stopped owing to the exhaustion of the profitable ore. The report for the year ended June 30 shows that 15,509 tons of ore was treated, yielding gold worth £18,878; in addition 4836 tons of accumulated sand and slime yielded £7572, bringing the total yield to £26,450. The profit was £8296, which was carried forward. The future policy is now under consideration.

Swaziland Corporation.—This company was registered in the Transvaal in 1898, by Lewis & Marks, to acquire a number of properties in Swaziland and in the Transvaal. Many properties have since then passed through the scope of operations of the company. The report for the year ended September 30 last shows that development has been done on many of the properties, but principally on the Forbes mineral concession in Swaziland. G. F. Heath was sent out to make a special investigation of the gold and tin deposits found in this tract. It was found that development in depth of the Forbes Main Reef gold mine would involve too great an expenditure, so the work was stopped. Attention is now being concentrated on the development of the Ivanhoe gold property, and to an alluvial tin property. The capital of the company is £200,000.

Witbank Colliery.—This company was formed in 1898, under local laws, to acquire coal-mining lands in the Middelburg district of the Transvaal, situated 90 miles east of Johannesburg. S. C. Thomson is consulting engineer, and J. K. Addie is manager, succeeding the late H. L. Tamplin Lewis, who had been in charge from the beginning. The sale of coal commenced in 1898, and the output gradually increased until 1909, since which time the figures have been fairly regular. There are two main workings, the Witbank and the Uitspan. During the year ended August 31, the former produced 538,060 tons, and the latter 208,563 tons, making a total of 746,623 tons. The company does not publish a revenue and expenditure account, but announces that the profit to the credit of this account for the past year was £73,994, and that the dividend paid absorbed £63,000, being at the rate of 30 per cent.

profit of £9789 on farming operations. The expenses of administration, interest on loans, and debenture interest totalled £26,183, and £7482 was allowed for depreciation. The net loss for the year was £17,206.

Offin River Gold Estates.—This company was formed in 1900 to acquire dredging rights over 40 miles of the Offin river, in West Africa. Additional property was afterwards acquired, bringing the length of the river rights to 158 miles. The company also owns a tin-gravel concession in Nigeria. The production of gold has been continuous since 1904, but no profit has yet been made. The report issued in December last covers the year 1911, and shows that the output was worth £23,340, a decrease as compared with the two previous years. The fall is explained by the sinking of one of the dredges by striking a rock while being moved from one position to another. The cost of repairs to the other two dredges was also con-



Vereeniging Estates.—This company was formed in 1897 by the Lewis & Marks group for the purpose of acquiring an estate at Vereeniging, part of the estate being north of the Vaal river and in the Transvaal, and part on the south, in Orange Free State. The Cornelia colliery on the south side is being worked. At one time it was intended to erect an electric generating station for the supply of power to the Rand, but subsequently the scheme was amalgamated with that of the Victoria Falls & Transvaal Power Co. The Vereeniging company subscribed for 150,000 preference shares in the Victoria Falls Co., and secured a contract from the latter for the supply of 120,000 tons of coal per year. The report of the Vereeniging company for the year ended September 30 last shows that the output of the colliery was 313,724 tons as compared with 300,351 tons the year before. The profit was £3499, which was less than the year before, a fall accounted for by the expenditure on improvements connected with hauling. The sinking of one of the shafts at the Camp pit on the north side of the Vaal river has been completed and the other shaft is in hand. This pit is close to the Victoria Falls power-station, and to the works of the recently organized Union Steel Corporation. The company also had an income of £3170 from rents and royalties, and made a

considerable. The total expenses, including debenture interest, were £27,983, and after including sundry income £174, the debit balance for the year was £4469. The issued capital consists of £252,917 in ordinary shares and £30,000 in preference shares; and there are £24,000 debentures. F. N. Best is chairman of the board, P. A. Westcott is manager at the Offin river, and George Bailey at the Nigerian property.

Northern Nigeria (Bauchi) Tin Mines.—This company was formed at the beginning of 1910 to acquire, from the Anglo-Continental Mines company, the N'Gell Areas, in the Bauchi district of Nigeria, together with prospecting rights over a large tract. Since then an interest has been bought in the Gurum River (Nigeria) Tin Mines company. The report for the 15 months ended June 30 last, shows that 386½ tons of concentrate was won by calabashing, and 363½ tons sold. The cost of production was £30 7s. 2d. per ton, and of royalty, freight, etc., £34. The receipts from the sale of concentrate were £48,553, and the divisible profit £24,172. The paid-up capital of the company is £97,226 in ordinary shares, and £111,810 in 10% preference shares. It is proposed now to pay the dividend on the preference shares up to June 30 last. The engineers' reports show that calabashing will have to be continued at present, for the transport

difficulties preclude the hope of obtaining delivery of the necessary plant for hydraulic mining. The output of at least 20 tons per month will be easily maintained by the primitive method.

Gurum River (Nigeria) Tin Mines.—This company was formed in February 1911 to acquire a tin-gravel property on the Gurum river, 5 miles northwest of Naraguta, Nigeria, from the Anglo-Continental Mines Co. The management was in the hands of the parent company until September last, when the arrangement was discontinued, the company appointing A. H. Flowerdew to the position. Mr. Flowerdew does not consider that the former sanguine views as regards the wealth of the property to be justified, and he has stopped sluicing, pending a thorough exploration by drill. In the meantime, calabashing is to be continued, with an estimated output of 4 to 5 tons of concentrate per month. The report now issued covers the period from the inauguration of the company to March 31, 1912. During this time, 160 tons of tin concentrate was recovered, the sale of which brought an income of £12,339, after royalty and freight charges were deducted. The net balance of profit was £940.

Gel Tin Lode & Alluvial.—This company was formed in 1910 to acquire from the Niger Co. an alluvial tin property in the Bauchi district of Northern Nigeria, close to those of the Naraguta and Jos companies, together with options to purchase tin-lode properties. The directorate includes the names of P. G. Hamilton Carvill and G. Ochs, and the report on the property was made by H. W. Laws. The report for the year ended December 31 last shows that both these properties were speedily abandoned, and that £10,000, part of the payment for them, has been refunded. Since then another property has been acquired. This adjoins the property of the Malayan Tin Dredging Co., one of the Ironoh group. It is situated on the Kampar river in the State of Perak. Boring operations have showed that the deposit is from 30 to 60 ft. deep, and arrangements are being made to acquire an area up to 500 acres. The ground is now being examined before the negotiations are completed.

Cobalt Town Site Silver.—This English company was formed in 1906 to acquire the whole of the share capital of a Canadian company of a similar name incorporated six months earlier. The mine is in the centre of the Cobalt district. It was worked from 1906 to 1909, and reopened in August 1910. The reports of the two companies now issued cover the year ended October 31 last, and shows that after a long period of anxiety the mine has arrived at a highly satisfactory position. Previous adverse balances have been wiped out and large dividends distributed. During the year, 24,974 tons was mined and sent to the Northern Customs concentrator, estimated to contain 27½ oz. silver per ton. The total recovery was 576,671 oz., or 84%. The sales to the smelters consisted of the following: High-grade ore 415 tons, containing 1,127,982 oz.; 725 tons concentrate containing 444,058 oz.; 225 tons slime containing 18,812 oz.; and 330 tons low-grade ore containing 38,766 oz.; total 1695 tons containing 1,629,619 oz. The amount received by the sale of these products was \$975,207. The profit at the mine after concentrating and smelting charges were paid was \$619,223. Out of this \$95,000 was paid as royalty and \$39,687 for administration. The dividends paid by the Canadian company totalled \$471,000, equal to £96,615. Of this £46,913 has been distributed by the London company, being at the rate of 25% on the issued capital less income tax, and £40,642 has been carried forward. Developments at the mine

are most encouraging. The actual reserve has been increased and the 'probable' ore also.

Casey Cobalt Mining.—This company was formed in London in 1907, to hold the share capital of the Canadian company formed a few months previously to acquire a silver mine at New Liskeard, 30 miles north of Cobalt, Ontario. The geological formation is the same as at Cobalt, and the nature of the metalliferous veins is practically identical. The mine has been proved to contain the thin silver veins characteristic of Cobalt, and small amounts of ore have been raised and sold. But much more mining and exploration work has been necessary than at the outcrop mines at Cobalt. The reports now issued by the English and Canadian companies cover the year ended September 30. During this period, a large amount of additional capital has been subscribed for the purpose of pushing developments, erecting a concentrator, and providing further power-plant, air-compressors, etc. The money required was provided by the issue of £30,000 debentures by the English company, and it appears in the accounts as a loan to the Canadian company. The recent development has given good results. Though the amount of ore disclosed is not great, its richness is considerable. During the year 48½ tons of high-grade ore was shipped, assaying 4711 oz. silver per ton, and 368 tons of lower grade ore assaying 123 oz. per ton. The ore blocked out and the ore ready for shipment have a total content of about 1,500,000 oz. The sale of ore brought an income of \$190,534, after the payment of smelting charges, and the net profit was \$120,665, which was carried forward.

Tomini (Mexican) Mining.—The mine belonging to this company has severely suffered at the hands of the revolutionists, and has been closed since July. The company was formed in 1906 to acquire, from M. Parry Gosset, the old San Felix silver-gold mine in the Tamazula district of Durango. We recorded the history of the mine in our issue of February 1912, detailing the various changes in management and control. Pearse, Kingston & Browne have recently been the consulting engineers, and H. Cribb was local manager until the mine was closed. The report now issued covers the year ended September 30 last. For the first nine months of this period, until the closing of the mine following the damaging attacks by bandits, the amount of ore treated was 8264 tons, which yielded bullion worth £37,750. The extraction by cyanide was efficient, 95% of the silver being recovered. The net working profit was £4446, which has been credited to the mine-development account. Development was hampered throughout the year, but what little was done revealed profitable ore. As regards the future, the directors are contemplating leasing the property to tributors.

Avino Mines.—This company was originally formed in 1899 to acquire a mine in Durango, Mexico, containing complex ores of lead, copper, silver, and gold. It was reconstructed in 1903 and 1909. R. H. Jeffrey is now the manager, and Hooper, Speak & Co. are the consulting engineers. The report for the year ended June 30 last shows that operations were continuous in spite of the revolutions, though transport was often suspended, and the cash and accounts had to be kept at the city of Durango. The amount of ore raised was 16,288 tons, of which 9092 tons was sold to the smelters, 300 tons added to the ore dump, and 6896 tons discarded. The ore sold averaged 3.05% copper, 15 oz. silver, and 1½ dwt. gold. The sales brought an income of £29,543. The expenditure in Mexico was £26,495, and other expenditure and allowances for de-

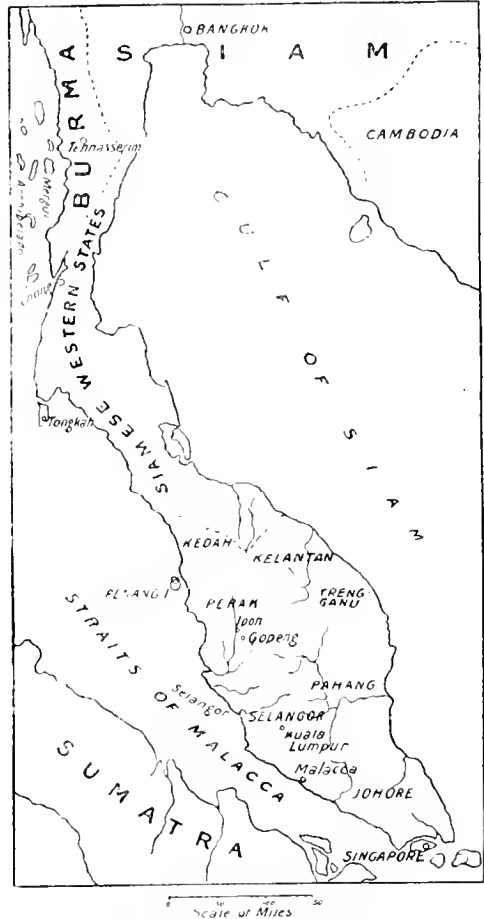
preciation and development brought the balance of profit and loss to the wrong side to the extent of £14 10s. 2d. During the last few months, tests have been made with the Murex magnetic process, and as the results have been satisfactory, a single unit has been ordered.

Wolfram Mining & Smelting.—This company was formed in 1909 to acquire, from the Buitenlandsche Bankvereeniging of Amsterdam, a number of wolfram mines at Silvaes, Portugal. These mines had been worked by a local company for some years, and on the formation of the English company, additional capital was subscribed for the purpose of extending operations and building additional dressing plant. Reports were made by J. D. Kendall and J. W. Anderson. Particulars were given in our issue of September 1909. The report now published covers the year ended September 30 last. During this time, 21,046 tons of ore was mined and milled, together with 2509 tons of old tailing. The amount of concentrate produced is not stated, but the income from its sale was £29,337. The net profit after allowance for depreciation was £8416. Out of this, £6000 has been distributed as dividend, being at the rate of 7½%, and £1500 has been allocated for development work. An aerial ropeway has been erected during the year, and the available area for mining operations thereby considerably extended. The development at the mines has continued to expose ore, though the veins are variable in content, and not easy to follow.

Renong Dredging.—This company was formed in 1908 to dredge for tin on flats adjoining the Renong and Pak Chan rivers in the Western Siamese States. A Werf-Conrad dredge started operations in the early part of 1910. The property was inspected by E. T. McCarthy, who is on the board. Frank Nicholls is manager, and during his present leave of absence, A. H. Handman is in charge. F. W. Payne & Co. are the consulting engineers. The company commenced the payment of dividends eighteen months ago. The report now issued covers the year ended September 30 last. During this time, 682,986 cu. yd. of gravel was treated and 267½ tons of tin concentrate recovered. The output would have been greater had it not been for a breakage in the machinery, whereby nearly a month's time was lost. The sale of concentrate brought an income of £35,376, or about 1s. per cu. yd.; while the working cost including royalties was 6d. After the allowance of £4373 for depreciation, the net profit was £12,132. Out of this, £6250 has been paid as dividend at the rate of 25% on the preference shares, and £1632 on the deferred shares being at the rate of 40%. Negotiations are in hand for the purchase of a large additional tract of ground immediately adjoining, and the prospects there are so good that a second dredge has been ordered.

Tongkah Harbour Tin Dredging.—This company was formed four years ago at Hobart, Tasmania, for the purpose of dredging tin-gravel on the sea-shore on Tongkah Island, off the coast of the Siamese Western States. We gave details of the venture in our issues of July and October, 1910, and recorded the fact that experts had widely differed in their estimates of the value of the deposit. The first yearly report, issued a year ago, proved that the deposit was profitable. The second report now issued, covering the year ended September 30 last, shows that the prosperity has been continued. The amount of gravel treated was 3,157,549 cu. yd., as compared with 2,217,343 cu. yd. the year before. The produce was 1385 tons of tin concentrate, as compared with 1142 tons. The average yield was just under 1 lb. per cu. yd., as compared with 1 15 lb.

The receipts were £153,465, being £110. 16s. per ton, or 11½d. per cu. yd., as compared with £117,487, £102. 15s., and 12½d. The working cost was £53,884, and £26,482 was paid as royalty or spent in work required by the Siam government as part consideration for the concession. The working cost per cu. yd. was 4d., as compared with 4½d. the year before. The total cost was 6d. The divisible profit was £80,366, and



Tin-Mining Districts of Siam and Malaya.

£84,563 was distributed as dividend, being at the rate of 55 per cent. Four dredges are at work, two built by Werf Conrad, and two by William Simons & Co.

Pengkalen.—This company was formed in 1907 by James Wickett, of Redruth, to acquire a tin-gravel property at Lahat, in the state of Perak, Malay Peninsula. Osborne & Chappel are the managers. Operations commenced in 1909, with monitors and floating barges, and the yearly output of black tin has been between 300 and 400 tons. Owing to the high price of fuel, shallow ground, and influx of water, the cost has been great, and no dividends have been distributed. During the past year, the remaining 10,000 shares have been issued as preference shares, bringing the total capital to £100,000. The report for the year ended September 30 last shows that three barges were at

work, treating 789,896 cu. yd., and winning 346½ tons of concentrate, the recovery being practically 1 lb. per cubic yard. The income from the sale of concentrate was £40,944, and the working cost £37,877. After the payment of administration and other expenses, £2,333 remained as profit. Out of this, £161 was distributed as preference interest, and the rest carried forward. A new electric station is being built, and by its means the power costs will be substantially reduced.

Seramban Tin Mining. This company belongs to the Kedrith group controlled by James Wickett, and was formed in 1897 to acquire alluvial tin properties near Seramban, in the state of Negri Sembilan, Malay Peninsula. Production has been continuous since 1899, as have dividends. The report for the year ended September 30 last, shows that 51½ tons of tin concentrate and 4 tons of wolfram concentrate were recovered. This is rather better than the year before, but only half of the output of the previous two years. The net income from the sale of tin concentrate was £5,935 and of wolfram £380. The divisible profit was £1,718, and £900 was distributed as dividend, being at the rate of 3½ per cent. Osborne & Chappel are the managers.

Treburland Wolfram & Tin.— This company has been formed to acquire an outcrop property on the edge of Bodmin Moor, 9½ miles from Launceston and 14 from Bodmin north Cornwall. W. J. Barnett is chairman of the board of directors. The capital is £50,000, divided into 60,000 preference shares of 10s. each and 40,000 ordinary shares of equal denomination. The purchase price is the whole of the ordinary shares and £3,000 cash. 40,000 of the preference shares are now on offer and the remaining 20,000 are being kept in reserve. Underwriting has been secured for 30,000 of the shares offered. The reports on the property have been made by H. Brian Pearson and E. W. Wetherell. From these it appears that five lodes have been traced on the surface, and three of them tested by several open-cuts. A prospecting shaft has been sunk 50 ft. on the 'Main' lode in ore that is high in wolfram. An adit is being driven. It is estimated, but on what data is not quite clear, that down to 100 ft. the reserve is at least 50,000 tons averaging 1% tin oxide and 3% wolfram. This property was the Wheal Anne of former days, when wolfram was a valueless article.

Falmouth Consolidated Mines. This company was formed in 1907 by the Schiff group to purchase the Wheal Jane and other old tin mines, situated a few miles southwest of Truro, Cornwall. These properties had been worked in earlier days, but the low tin content and the large amount of pyrite present had caused their abandonment. The preparation of the concentrate for market by the necessary elimination of the iron has caused the company much anxiety and research. As was recorded in this magazine for October last, the roasting of the concentrate is now done in Humboldt furnaces, and the iron oxide produced subsequently comminuted in a tube-mill so that it can be readily removed by further concentration processes, the tube-mill being so arranged that the tin oxide is not crushed any finer. The report of the company now published covers the fifteen months from April 1, 1911, to June 30, 1912. Figures for the total amount of ore crushed and the yield therefrom are not given. It is stated that, during the first 13 months of the period, 20 stamps were at work, and that 140½ tons of concentrate produced sold for £14,727. For the remaining 3 months and during the next 5 months, after the conclusion of the period under review, 40 stamps were at work, and the yield of tin concentrate was 200

tons, selling for £26,686. Since that time, 10 stamps have been added and a further 10 stamps are expected to be in operation within a month's time, bringing the whole installation up to 60 stamps. So much time and money has been spent recently on treatment plant and surface equipment that little has been done in development, but A. K. Shutes, the manager, is of opinion that the reserve is sufficient to supply the 60 stamps for twelve months. The directors state that the expected extraction is 19 lb. black tin per ton. The accounts show that £79,324 has been spent in cash on equipment, development, and management up to March 31, 1911, and that since then the expenses have totalled £38,108. The sale of tin during the period under review brought an income of £20,182. The capital of the company is £119,684, of which £80,034 formed the purchase price in shares. The company is saddled with £43,500 in participating bonds, £15,400 in convertible bonds, £20,852 sundry loans, and £10,415 sundry creditors. A scheme is on hand for re-arranging the finances of the company.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

Head, Wrightson & Co's. most recent pamphlet gives all the details and specifications of the Nissen Stamp Prospecting Plant, which is something more than the usual makeshift affairs of this description.

Thompson & Co., of Castlemeane, Victoria, are known to many engineers as the designers and manufacturers of gravel-pumps. Their new catalogue describes the separate units as well as complete dredging and hydraulic mining plant.

The Sturtevant Engineering Co. have just published catalogue No. 1551, which presents the usual attractive appearance of the other catalogues of this firm, and describes their crushing, grinding, screening, and concentrating machinery.

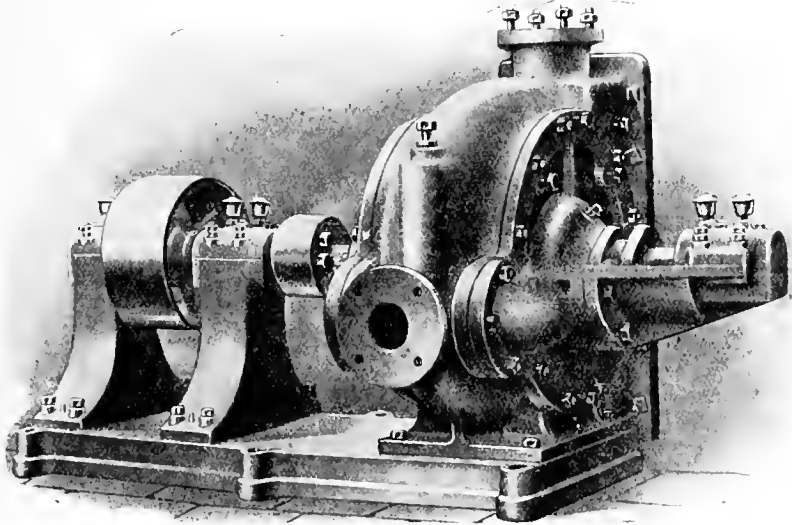
The Hardinge Conical Mill Co. announce orders for two 8-foot Pebble-Mills from the Butte & Superior Copper Co., and three of the same size for the Commonwealth Mine of Arizona. This company has opened a London office at Salisbury House. J. C. Farrant will act in an advisory capacity concerning technical details of mills controlled by the Hardinge company.

R. Wolf issue a 72-page catalogue describing by means of thoroughly well-chosen reading matter, coupled with numerous and excellent illustrations, the points of advantage to be derived by using Superheated Steam Locomobiles. These machines comprise in one unit a complete self-contained Steam Power Plant requiring minimum floor space and light foundations, without necessitating complicated brick-work or a capacious building. The main point of interest to engineers is the high percentage of efficiency and fuel economy. The manufacturers make claims which might at first glance appear impossible, but for the fact that they create confidence in their statements by guaranteeing the quantity of steam that can be produced from each pound of coal used per brake horsepower-hour. By adjusting the fire-box, any kind of fuel can be utilized, including waste products such as sawdust, chips, and husks. Over 6000 of these machines are in use.

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DRESSING MACHINERY.
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WINDING ENGINES ALL SIZES.

COBALT TOWN SITE SILVER MINING CO. OF CANADA, Ltd.

THE adjourned meeting was held at Salisbury House, E. C., on January 17, Col. Sir Augustus C. F. Fitz-George (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts, said that he was glad the present position of the company was so satisfactory, and that he hoped they would be able to forget their past difficulties, and look forward to the future with confidence. It was proposed in future to make a change in the date of the accounts, which, in future, would be brought up to September 30 instead of October 31. This would avoid holding the meeting during the Christmas period and would also enable their Canadian colleagues to be present. The debentures had now been wiped out. Dividends paid during the year spoke for themselves, and the board had every confidence that the returns for the current year would considerably exceed those of the last financial year. They hoped, within a few days, to declare a quarterly dividend.

Mr. W. R. P. Parker said that it afforded Mr. Watson and himself much pleasure to be with the shareholders that day. They had a rather important announcement to make, as, late last night, a cable had been received that they had cut the big vein known as the X, on the Town Site Extension property, at a distance of about 300 ft. from the end of the present drift, and from this they had, apparently, cut this vein 300 ft. further on, just across the Town Site boundary, and it would appear to have a length of 600 ft. on that very large vein. It was not only the largest vein they had cut, but was one of the largest ever encountered in Cobalt camp, and for certainty it was the longest vein which they had on the mines at present. Last year he had ventured the opinion that a dividend of 5% could be steadily maintained, if not increased. These anticipations had been more than surpassed, and notwithstanding the 40% paid during the year, there was still a strong reserve in cash and quick assets. As to the progress at the mine last year, their weekly earnings were at the rate of 25% on the capital of the company; today they were between 70 and 75%. Starting, therefore, with a production of, say 70%, the Canadian directors saw no reason why, during the present year, profits could not be increased to something in the neighbourhood of 100%. If that were so, they would not only be able to increase their cash and liquid assets, but there should be sufficient funds in hand to pay substantially increased dividends. During the past year, they had more than doubled their ore reserves, and expected to make still further progress. During the year, they had mined ore producing 1,700,000 oz., and notwithstanding this, the ore reserves were practically 2,000,000 oz. Last year, the weekly production was practically 23,000 oz. silver, and they proposed to increase it gradually to 30,000 oz. The figure of 30,000 was passed early in the year, and, at the present time, they were producing approximately 40,000, and the figures would, no doubt, be largely increased.

Mr. J. P. Watson said that the board proposed increasing the milling capacity by at least 50 tons per day, bringing up the production to 200 tons per day on the Town Site. Fifty tons extra did not seem very much, but it would mean at least £2 per ton net profit, which would be £100 per day, or £30,000 for the

year, or 15 per cent on the capitalization of the mine. The report was adopted unanimously.

CASEY COBALT MINING CO., LTD.

THE adjourned fifth ordinary general meeting was held at Salisbury House, E. C., on January 17, Col. Sir Augustus C. F. Fitz-George presiding.

The Chairman, in moving the adoption of the report and accounts, said that that time last year the company was in a far from satisfactory position, so it gave him pleasure to be able to tell the shareholders that not only had they turned the corner, but were in a thoroughly sound financial condition. In the early part of last year, the company was in low finances, and it was found necessary to make an issue of £30,000 in convertible debentures. Owing to the satisfactory development of the mine, the rights of conversion had been exercised to the extent of £28,800, thus leaving only the trifling balance of £1,200, which, no doubt, would also be converted very shortly, and when that was done, the mine would be free from any debenture indebtedness. The past year had been one of construction and getting ready for big work. The development of the mine has been successful. With the increased hoisting capacity, besides the erection of a mill to handle the low-grade ore, they were now ready to really do work and achieve steady production. The mine, which a year ago was in a far worse position than Town Site was two years ago, was now in such a state that this year they expected to pay a good dividend, because not only had they good ore reserves, but had a great deal of ore ready broken to hoist when the new shaft came into use, which would be about March 1.

Mr. W. R. P. Parker, the president, said that they were looking forward to entering this year the ranks of the first half-dozen or so of the big producing mines of the Cobalt camp. Within six weeks from that day, they would be able to commence a weekly output from the mine, and they expected to commence with an output of about 15,000 oz. per week. Once this fixed weekly production was commenced, they believed they would be quite justified in entering upon a dividend-paying career, and they hoped and believed it would be a long one. The outstanding feature of the year's work was the discovery of the big vein known as No. 6, which was admitted on all hands to be one of the most important veins ever discovered in the whole district. The first car of ore taken out gave the phenomenal result of \$132,000, or about £26,000. That established a new record as the richest car of ore ever shipped from the Cobalt district, and possibly the richest car of ore for its tonnage ever shipped anywhere. That vein had been developed by three rises, a drift at the 210-ft. level, a drift at the 100-ft. level, and a winze from the 210-ft. level, and the engineer's report showed blocked out on September 30 last 460 tons of high-grade ore in that vein, which, at an average of 3000 oz. of silver to the ton, should give silver contents so far blocked out on that vein amounting to 1,218,000 oz.

Mr. J. P. Watson, referring to the low-grade ore, said that, as compared with the Town Site, the Casey low-grade ore ran an average of 10 oz. to the ton richer than the Town Site, or, say, 40% richer, and the low-grade ore in the Town Site was very good. He

thought their net earnings for the coming year on the Casey should be from 35 to 40%. Their serious problem was power. It was a hard matter to keep their power at all sufficient for the mine, but they were now investigating oil engines, and, if successful, the cost of power production would be reduced.

The report and accounts were adopted unanimously.

FALMOUTH CONSOLIDATED MINES, LTD.

THE adjourned ordinary general meeting of the shareholders was held on January 29 at Salisbury House, E.C., Mr. Horace Barrett (chairman of the company) presiding.

The Chairman said that they had deferred the preparation of a profit and loss account until there had been a sufficiently prolonged run with the full plant. The erection and setting to work of the three Humboldt furnaces had proved of the greatest importance in the successful treatment of the highly pyritic ores, and, with the aid of these and the really efficient fumes absorption plant, they had definitely overcome all difficulties of recovering the black tin from the concentrate, and, what was more, they were getting an excellent percentage of extraction and realizing very satisfactory prices at the ticketings.

As regards the developments underground, these of late had become of a very encouraging nature, and as soon as the cross-cut to the Falmouth shaft had been completed they would get into a position to open up considerable quantities of payable orebodies down to 60 fathoms below the adit in the Green's ore-shoot. It was gratifying to be able to state that the output for the four weeks ended January 17 constituted a further record from the working of 40 stamps, showing a production of over £1000 per week, from which an approximate working profit of over £350 per week was derived. As since the middle of last week their full 60 stamps had been running they expected a further considerable rise in the next four-weekly output, and they could, therefore, feel pretty confident that the working profit at the rate of about £30,000 per annum (as anticipated in the directors' report) would be realized from the operations of the full plant from now onwards. In consequence of their having definitely proved the payable nature of extensive ore deposits in the eastern portion of the company's property, a greatly enhanced value was thereby put on the similar—and in some sections much richer—orebodies existing above and below the adit on the extensions of the lode through the West Jane mine and the greater portion of the Nangiles property for an approximate length of 2½ miles. The time was near at hand when these important unworked areas would have to be brought into the sphere of operations, either by the installation of additional crushing plant or possibly by the formation of subsidiary companies.

Mr. C. S. Goldman, M.P., seconded the resolution, and said he did not think he was indulging in undue optimism when he said they would, with the new machinery, be able to produce and crush 60,000 tons a year for a yield of £71,000 worth of tin, which would yield a profit of £26,000 a year.

The Chairman, replying to questions, said that, with regard to wiping out the liabilities of the company, it was the directors' intention to issue bonds, which would be offered to the shareholders.

The resolution was carried unanimously.

RENONG DREDGING CO., LTD.

THE fourth annual general meeting of the Renong Dredging Company, Ltd., was held on February 10, at 5, Whittington Avenue, E.C., Mr. Arthur Forbes Nicol presiding.

The Chairman said that in the management of dredging operations they had the great advantage of having Mr. E. T. McCarthy as a director and Mr. Payne as dredge consultant. As their advisor when proving the property, as well as when ordering the dredge, Mr. McCarthy's knowledge of the ground led them to choose an excellent type of vessel, and they had every reason to be satisfied with the work of the builders. Messrs. Werf Conrad, of Haarlem. The second dredge referred to in the report had been ordered from the same firm at a cost of £20,000, erected and delivered at Renong, and he trusted they would have the same complimentary remarks to make about it. The great advantages in dealing with Messrs. Werf Conrad were that they attended themselves to the erection of the dredge in the East, that they delivered it afloat near the property, and guaranteed its running for six months. The output of tin ore for the twelve months at 267 tons exceeded that of last year by only 26 tons, but they hoped, barring accidents, to do better this year. During the later months of the last financial year, they had a long run in ground below what is regarded as the average grade, but their manager decided to take this in order to recover, on the return journey of the dredge, a long strip of much higher grade ground, which would otherwise have been sacrificed. Since the close of the financial year they had the benefit of this better ground, the output from October 1, 1912, to January 31 last, being 153 tons of tin ore, against 98 tons for the same period of 1911-12.

The report made mention of the acquisition of the mining rights over an additional area of ground, for which they had ordered a second dredge. The new ground adjoined the present property, and the lease covered about 320 acres, in addition to which they had been granted prospecting rights over a further 1000 acres. A considerable portion of the 320 acres had been bored, with satisfactory average results.

The net working profit, after payment of all administration expenses, was £16,502, or about £1500 better than for the year to September 30, 1911. From the sum they had deducted the statutory amount of £1700 as reserve for amortization of dredge, and had allocated a total of £2670 to writing down property, buildings and other capital items. The balance remaining, namely, £12,132, provided the fixed 15% dividend on the Preference shares, already paid, and also the further 10% dividend on the Preference shares, and 40% dividend on the Deferred shares.

The motions to adopt the various resolutions were carried unanimously.

WANTED An experienced Engineer for the Balkans to take charge of the erecting and management of a large chloridizing, washing and leaching plant for the extraction of copper from brown-iron ore and pyrites. The knowledge of either German or the French language desirable. Reply A.C. c/o Mining Magazine

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Scientia non habet inimicum nisi ignorantem.

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EDGAR RICKARD, Managing Director.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb

	Dec. 31 Tons	Jan. 31 Tons	Feb. 28 Tons
In England	27,761	25,420	23,937
In France	4,396	4,278	4,084
Aboard from Chile	2,800	2,500	2,325
Aboard from Australia	5,400	6,000	5,800
In Rotterdam	1,000	1,400	4,100
In Hamburg	1,882	3,503	4,427
Total European visible supply	43,241	43,101	44,673

AMERICAN COPPER PRODUCERS ASSOCIATION'S FIGURES
In Tons of 2240 lb.

	Production		Deliveries		Stocks at end of month
	Dome- stic	Foreign	Total	Total	
Total, 1911	639,258	316,791	537,009	653,800	—
Total, 1912	706,052	365,920	533,212	694,132	—
January	64,053	29,111	26,956	56,067	55,000
February	58,460	26,641	32,219	58,860	54,600

PRODUCTION OF GOLD IN THE TRANSVAAL.

	Rand	Else- where	Total	Value
	Oz.	Oz.		
Year 1912	8,753,563	370,731	9,124,299	38,757,560
January 1913	760,981	28,409	789,390	3,353,116
February	702,394	31,728	734,122	3,118,352

COST AND PROFIT ON THE RAND

	Tons	Yield		Cost		Profit		Total profit
		per ton	per ton	per ton	per ton			
1911	23,888,260	27.7	18.0	9.7	11,414,863			
January 1912	2,067,161	27.6	18.10	8.11	997,557			
February	1,989,396	28.3	19.2	9.2	907,192			
March	2,163,998	28.1	18.11	9.0	1,204,764			
April	2,059,562	28.6	19.0	9.8	1,605,920			
May	2,177,348	28.6	18.9	10.0	1,073,534			
June	2,110,657	28.5	18.6	10.1	1,063,634			
July	2,149,785	28.6	18.8	9.11	1,061,089			
August	2,121,455	28.9	18.10	10.0	1,955,315			
September	2,081,295	28.7	18.8	10.0	1,040,820			
October	2,200,709	28.0	18.3	9.10	1,079,334			
November	2,155,690	28.2	18.5	9.10	1,059,564			
December	2,218,305	28.0	18.0	10.3	1,129,372			
January 1913	2,296,948	27.8	18.0	9.0	1,113,570			

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
January 31 1912	184,046	7,805	9,524	201,375
February 29	190,320	7,622	10,789	209,301
March 31	196,748	8,198	12,071	217,017
April 30	197,937	8,364	13,785	220,086
May 31	198,829	8,460	14,538	216,827
June 30	188,494	8,549	15,530	212,573
July 30	182,025	8,497	15,834	207,256
August 31	174,111	8,766	15,934	203,811
September 30	180,739	8,783	15,752	205,274
October 31	182,058	8,903	15,496	206,357
November 30	186,881	8,767	14,872	210,520
December 31	191,216	8,654	14,965	214,915
January 31, 1913	200,090	8,789	17,912	227,991
February 28	207,662	8,877	13,918	230,457

GOLD OUTPUT OF INDIA

Year 1911	Year 1912	Feb. 1913	Year 1913
£2,150,050	£2,265,094	£1,198,114	£367,591

PRODUCTION OF GOLD IN RHODESIA

MONTH.	1909	1910	1912	1913
January	204,666	227,511	214,918	320,776
February	192,497	203,888	209,744	—
March	202,157	228,385	315,102	—
April	222,700	228,213	221,476	—
May	225,032	224,888	234,407	—
June	217,600	214,799	226,867	—
July	225,234	195,233	240,514	—
August	228,896	191,423	239,077	—
September	213,249	178,950	230,573	—
October	222,653	234,928	230,672	—
November	236,307	240,573	225,957	—
December	233,397	199,500	238,661	—
Totals	2,623,788	2,568,301	2,707,368	—

PRODUCTION OF GOLD IN WEST AFRICA

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
January	15,903	66,107	26,098	107,262	34,857	144,262
February	15,179	63,081	25,809	102,370	—	—
March	16,387	67,673	27,228	111,376	—	—
April	17,237	70,880	27,790	114,796	—	—
May	24,427	96,409	28,015	115,678	—	—
June	22,555	92,174	27,784	114,697	—	—
July	22,510	91,955	30,974	127,800	—	—
August	25,385	103,753	33,015	136,407	—	—
September	26,717	109,039	34,491	142,397	—	—
October	26,826	109,503	34,436	142,414	—	—
November	24,289	99,299	33,183	137,790	—	—
December	24,369	99,569	34,917	144,382	—	—
Totals	261,784	1,069,442	362,910	1,497,179	—	—

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.		Mint oz.	Total oz.	Total value £
	Total, 1910	363,496			
Total, 1911	160,021	1,210,447	1,370,468	5,823,522	
Total, 1912	83,589	1,199,080	1,282,669	5,449,057	
January 1913	9,738	94,967	104,705	441,756	
February	8,780	92,207	100,987	428,963	

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	February 1913	1913 to date
	Victoria	2,138,000	2,039,400	106,400*
Queensland	1,623,390	1,484,160	87,500*	—
New South Wales	769,353	702,129	40,397	112,959
New Zealand	1,808,049	1,345,115	120,323	245,226

* January figures only

SALE OF TIN CONCENTRATE AT REBUTH TACKETINGS

Year	Tons	Value	Average	
			£	¢
Year 1911	615 1/2	£702,599	£114	4 5
Year 1912	649 1/2	£831,908	£128	5 0
January 6, 1913	231	£32,769	£141	17 2
January 20	257 1/2	£36,647	£142	9 1
February 3	260 1/2	£36,221	£138	18 3
February 17	236	£32,393	£137	5 2
March 3	252 1/2	£33,251	£131	13 9

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA
Reported by A. STRAUSS & Co.

	1912 tons	Feb. 1913 tons	1913 tons
Metal from Straits to Europe and America	59,036	4,669	10,723
Metallie Content from Bolivia to Europe	21,149	2,118	3,747

REVIEW OF MINING

INTRODUCTORY.—The general position has improved slightly, but not so much as was anticipated. In the Balkans the war drags along and the combatants exhibit increasing signs of insolvency. Janina has been captured by the Greeks, but Adrianople is unconquered. Pourparlers for peace are again being initiated. European tension has been relaxed by the promised demobilization of the Russian and Austrian armies, but it has been revived in the west by the raising of large loans for military purposes in France and Germany. For the moment, the financial stringency at Berlin, the possible complications over Albania, and the uncertainty as regards the Mexican position are factors making for depression. In America the new President has been inaugurated and the so-called big business interests have accepted the change with comparative equanimity. On the whole, financial conditions are healthy, but inactive. However, should the Balkan war come to a sudden end, as is daily expected, there would be an increase of speculative activity in business generally, and in mines particularly. The metal markets are weak, by reason of the general check to industrial expansion. Lead especially has fallen enough to hurt Broken Hill. Copper has been acutely depressed recently, but now gives signs of recovery. Zinc is shaky, the German syndicate being unable to maintain prices.

TRANSVAAL.—The first month of 1913 made a good showing in the gold and labour statistics. The yield of gold, namely, 789,390 ounces worth £3,353,116, is the highest recorded save that of March, 1912, when the output was increased abnormally by extinguishing the reserves, valued at £297,946. In February the yield fell to 734,122 ounces, worth £3,118,352, but it must be remembered

that February has only 28 days. Last year was leap-year, so that this February, with 734,122 ounces, compares splendidly with the 703,866 produced last February. The daily output of the Transvaal is now 26,218 ounces, which is the highest recorded hitherto. Even more encouraging are the labour returns, showing a gain of 7572, as against the January supply, and a total of 207,662 natives employed on gold mines, as against 190,320 twelve months ago. Undoubtedly the drought has driven the natives to work on the Rand, but, no matter what the cause, the relief from labour stringency will prove most welcome to the mine managers.

Mr. R. C. Marriner, president of the Mine Managers' Association, stated recently that the revised schedule of wages would save £220,000 annually to the Rand, that great progress had been made in allaying dust underground, and that the operation of the Phthisis Act had caused a dearth of skilled miners, especially for development operations, making it incumbent upon each company to assume its share of training new men for the work.

The board of the Brakpan Mines has decided to increase the number of stamps from 160 to 200. The extent of the reserves and the satisfactory nature of the developments have long warranted such a course, and only the scarcity of labour has stood in the way of it being adopted. The prospects of an increase in labour supply have recently improved.

Sand-filling has been in operation at the Witwatersrand Deep since August. In the north section of the mine, above the East Rand dike, the sand is delivered through a bore-hole, and in the south section, below the dike, through a winze. The sand is taken direct from the vats, and permanganate of

potash is added to neutralize the cyanide. The cost of handling the sand at the surface is practically the same as when it was sent to the dump, and the cost of lowering it into the stopes is about 2½d. per ton. The advantages in connection with the increased safety in the mine are, therefore, gained at a small expense.

Unusual interest attaches to the recent developments at the Consolidated Main Reef. The No. 3 vertical shaft intersected the Main Reef series at 2365 ft. At this level a dike has caused a small upthrow of the 'reef' to the north of the shaft, but the displacement is not sufficient to interfere with the general scheme of development. In other directions the 'reef' has been proved to average 17½ dwt. over 4 feet, and the prospects in the deep portions of this property are, therefore, deemed highly encouraging.

Operations at the Rand Klip, situated to the east of Modder B. and belonging to the Anglo-French group, have been suspended owing to the failure to find profitable ore. Development had been started by two 5-compartment shafts, but only one of these was sunk to the Main Reef series, which was intersected at a depth of 1804 ft. in June last. A large amount of driving was done in both directions, but the best return was only 4 dwt. over 20 inches, so the company has had to admit failure.

The metallurgical plant at the Geduld is expected to be ready before the time originally contemplated, namely, the end of May. Development continues to give satisfactory results. The main incline-shaft has reached the horizon of the No. 3 level, which is 1000 ft. on the dip below No. 2. Samples at the station at No. 3 level show an average of 12 dwt. over 48 inches.

Randfontein Central affairs are again to the fore, by reason of the strictures passed upon the former management by Mr. C. A. Ferguson, the most recent manager. He makes some assertions highly damaging to the reputa-

tion of his predecessors. Until they have had a chance to reply, it would be unfair to accept his *ex parte* statements.

The Butters filter is now being installed at the Randfontein Central, the Van Ryn Deep, and the Geduld, where the capacities per day will be 1500 tons, 900 tons, and 500 tons respectively. The filter also forms part of the equipment at the Shamva mine in Rhodesia.

The continued improvement in the returns from the Meyer & Charlton must be gratifying to directors and shareholders alike. In February the yield rose to 49s. 10d. per ton and the profit for the month for the first time exceeded £20,000. It was £20,073. The northwestern development of the City Deep on the Main Reef Leader promises well for the Meyer & Charlton.

The accident due to overwinding at the Kimberley-Roodepoort shaft of the Roodepoort United Main Reef company has not proved so serious as at first feared, for hoisting was resumed after a delay of only three weeks.

RHODESIA.—The output of gold during January was worth £220,776, as compared with £218,661 in December. The continued fall month by month since July last, caused by the drought, has thus been checked. The variations at individual mines present no point of interest.

The Wanderer is noted for the low grade of its ore, which is a banded ironstone. The extraction is 8s. 6d., and the working cost 7s. 6d. per ton. The latest report announces the discovery of a body of ore 45 ft. wide, and averaging 7½ dwt., "not reduced." It would be wiser to adopt the usual plan of eliminating some of the exceptionally high figures before striking the average. In any case, other dimensions besides width are required before the value of the discovery can be judged.

The Chartered Company's report is an index of industrial progress in Rhodesia. For that reason it is important, and in some ways

disappointing. The dominant feature was the poor harvest, due to the drought. Mining operations are said to have suffered from a restricted supply of capital, caused directly by an adverse money market, but, in our opinion, traceable in part at least to a lack of public confidence in the administration of Rhodesian mines. This year several new mining enterprises come to fruition and the yield from them ought to be pleasantly felt. The accounts presented with the report show that the company continues to be more than self-supporting, this desirable condition having been attained two years ago. We note with satisfaction that the development of the land for agricultural purposes of all kinds is receiving the close attention of the administrators. By the way, quite a number of mining engineers of prominence in South Africa have during the last year or two left their original profession and taken to farming, the latest being Mr. Andrew Robertson, who did such excellent work at the Wolhuter. The Chartered shares have recently fallen on the Stock Exchange from 27s. to 23s. 6d., for no obvious reason.

We discuss the Globe & Phoenix affair on another page. Mr. T. Blair Reynolds, the chairman, met the shareholders informally at Edinburgh on March 12, and promised to visit the mine himself at an early date.

WEST AFRICA.—The output of gold, as given by the Chamber of Mines, was practically the same in January as it was in December, namely, 34,857 ounces, worth £144,262. Among individual gains we note the Abbontiakoon, where an increasing tonnage is yielding a proportionate amount of gold, the 9087 tons crushed in January giving gold worth £22,065. The Prestea, Taquah, and Broomassie maintain a steady output. This can also be said, fortunately, of the premier West African mine, the Ashanti Goldfields. The dredging companies did well. Indeed the only recessions are those recorded by the Abosso and

Bibiani, the one decreasing £2912 and the other £2622, as compared with December.

The Abbontiakoon is making a greatly increased output of gold, owing partly to the difficulties in clarifying the solutions having been overcome, and partly to the stoping-width having been reduced from 60 to 48 inches, consequent on the greater efficiency of labour. The January returns show a yield of 48s. 7d. per ton, as compared with 41s. 7d. in December and 36s. 11d. in November. The profit per ton was 20s. 3d., as compared with 9s. 8d. in December and 7s. 2d. in November. As noted recently, the Abbontiakoon profit is real, not phantasmal.

Mr. J. M. Iles reports that at the Rayfield large additional areas are being prepared for sluicing. The road to Rahamma has been put into excellent condition, suitable for the motor-wagon, which is now on the way. The use of this wagon will release much labour at present employed in carrying, and make it available for an extension of mining operations.

Material for the pipe-line at the Bisichi property is commencing to arrive. Mr. J. C. Penney reports that he has sampled 32 acres since his arrival in October last, and has proved the area to contain 682,440 cu. yd. averaging 3.56 lb. per yard.

The Anglo-Continental report states that the representations made by some of the company's former officials concerning the Jemaa "have been almost entirely discredited by the results of further prospecting and development work." This would be a correct statement if "almost" were deleted.

AUSTRALASIA. — Unfavourable comment has appeared in regard to the postponed publication of Mr. C. S. Herzig's report on the Great Cobar. References to share transactions on the part of an important group have been made, but we know of no confirmation of this rumour. However, the delay in issuing the report to the shareholders was a blunder.

The West Australian Government has made a big mistake in its treatment of the Mountain Queen, as disclosed by the correspondence between the company's secretary and the Premier. After making its own arrangements to obtain water at 1s. 6d. per thousand gallons, the company is suddenly ordered to purchase water from the Government at a cost of 7s. per thousand gallons, this being the price charged at Kalgoorlie, 138 miles farther inland. Such an overbearing and unreasonable interference with legitimate mining operations will hurt the State. Mr. J. Scaddan, the Premier, undertakes to investigate the matter on his return to Perth, but the delay is not necessary, and it is highly impolitic.

The latest news from the Mount Morgan mine is to the effect that an entirely new smelting plant is to be erected, to include all the latest improvements in metallurgical practice, and suitable for the requirements of pyritic smelting. It was not possible to adapt the present plant for this purpose satisfactorily. The old chlorination plant has been dismantled, and the silicious output treated by that method for many years now goes to the smelter. The addition of so much silica to the furnace-charge has the effect of slightly increasing the cost of smelting, but the improved extraction of gold obtained by the new method more than compensates. The mine has a reserve of nearly $1\frac{1}{2}$ million tons of ore averaging $3\frac{1}{2}\%$ copper and 10 dwt. gold, and nearly 2 millions tons averaging $2\frac{1}{2}\%$ copper and 5 dwt. gold. The bottom of the mine is still in good ore. The direction of metallurgical operations is in the hands of men thoroughly experienced in the latest phases of copper smelting.

The cabled summary of work done by the Broken Hill Proprietary during the six months ended November mentions that the ore reserve is estimated at 2 million tons, which at the present rate of treatment will last for 10 years;

also that the stock of zinc tailing awaiting treatment amounts to 1,150,000 tons. The directors have decided to greatly increase the rate of extraction of the ore and are instituting double-shift; the reason being that larger profits can be made by treating their own ore than by using their smelters for custom work. Some of the custom contracts have therefore not been renewed. We are informed that scarcity of labour continues to interfere with the operation of the zinc-distilling furnaces. Of the 10 erected, only four or five are regularly at work. The production of spelter during 1912 was 2260 tons, and of zinc-dust 284 tons. The total yearly capacity of these furnaces is 10,000 tons. The issue of new shares to provide the capital for the establishment of the iron and steel industry was not as successful as expected. The applications for the 240,000 shares of 8s. nominal, offered at £2, amounted to about three-quarters of the whole.

The fire at the Consols mine belonging to the Mount Elliott copper company is under control, but still smouldering. At the Mount Elliott mine itself the orebody continues to develop in an encouraging way below the 5th level. At one time the outlook at this mine was gloomy, but six months ago an important discovery was made on the southwest cross-cut on the 5th level. It is now announced that, in the winze sunk 65 ft. from this level, the last 7 feet contains ore averaging 10% copper, and that the working is still in ore.

The Chillagoe company, with a multitude of mining, smelting, and railway interests in Northern Queensland, has had to raise additional capital once more. This time it is required for the development of its coal properties at Mount Mulligan, 30 miles to the north-east. A Government railway is in course of construction to connect the coalfield with the Chillagoe railway system. The company was originally formed in Melbourne in 1898, and the capital has been re-arranged and increased

several times, but no dividend has yet been paid. There is also a heavy debenture debt. The latest purchase was the Einasleigh copper mine. The financial scheme now completed involves the re-construction of the company, with an assessment of 3s. on each of the 1,175,000 shares of 10s. each.

Mr. A. H. Marker, the chairman of the South Kalgurli, was able to give a highly creditable account of his stewardship, and that of his co-directors, to the shareholders at the recent annual meeting. We do not wonder that the shareholders gave their cordial support to the proposal whereby the South Kalgurli becomes amalgamated with the Hainault, its neighbour to the north. This fusion of interests should prove mutually satisfactory, for it will thereby be possible to develop in a more satisfactory manner the Morty lode passing through the two properties near the western boundary. The scheme of re-construction provides £25,000 additional capital. The principal asset of the South Kalgurli continues to be the Lake View lode, farther east, which does not pass through the Hainault property. On the 1200-ft., 1500-ft., and 1800-ft. levels the Lake View lode has been much poorer than nearer the surface, and the ore averages less than 6 dwt. per ton, but the present indications at the 1800-ft. level are more hopeful.

The final decision of the Great Boulder Proprietary to not exercise the option of purchase on the Great Victoria mine comes as a surprise, as it was supposed that the property made an excellent showing. The later exploratory work indicated "a consistent decrease" in the assay-value of the ore from "the extension of the shafts and winzes." This justifies Mr. Richard Hamilton in his tardiness to close the deal, and shows the great value of proper care in such matters.

CANADA.—Our correspondent at Toronto sends the latest news from Cobalt and Porcupine. In both districts a good deal of profit-

able activity is manifest. The finding of rich ore in the Keewatin formation within the McKinley-Darragh property is interesting, but geological details are lacking. Developments at the Casey Cobalt are giving excellent results. In the winze below the 160-ft level, vein No. 3 is 6 in. wide, averaging 3000 oz. silver per ton. On the 260-ft. level a new vein, No. 5, has been found, 1 inch wide and assaying 2000 oz. per ton.

UNITED STATES.—Our San Francisco correspondent sends an interesting letter. We also publish an article on the Seward Peninsula by Mr. C. W. Purington. The Alaska Gold Mines, built upon the old Alaska Perseverance, is prominent among recent American enterprises. It is the flotation of Hayden, Stone & Co., assisted by Messrs. Holden and Jackling. An adit 700 feet below the former Perseverance workings is being advanced to develop a lode 70 feet wide, of ore supposed to average \$1.50, and to be exploited for 75 cents per ton. It is a great venture, and backed by brains, as well as capital.

MEXICO.—We discuss the position on another page. In our Special Correspondence will be found some excerpts from a letter written, at the time of the last revolution, by a well informed mining engineer residing at Mexico City. He is sanguine of a change for the better. Meanwhile the fighting at Saltillo may affect the Mazapil Copper Co., and the talk of a secession of four northern states may cause anxiety to Anglo-American mining enterprise in Chihuahua and Sonora. The position is still obscured by disorder, but signs of betterment are apparent.

Confidence in the new Mexican regime is indicated by the issue of the prospectus of the Selected Mines of Mexico, with 100,000 shares of £1 each, of which 33,330 shares are offered. Dr. Hans Sauer is chairman and managing director under an arrangement indicating confidence in the enterprise, for his remuneration is entirely dependent on the company's suc-

cess. The Denny Bros. act as consulting engineers, taking part payment in shares. Three properties are under offer: the Leona, in Oaxaca; the Concepcion, in El Oro district; and the Ohio, at Pachuca.

Mr. R. T. Bayliss's most recent report on the El Oro goes far to confirm the correctness of the advice given by him, and accepted by his co-directors, a year ago. The restriction of output has enabled the manager, Mr. A. F. Mann, to accelerate development in the more promising portions of the mine, with the result that fresh reserves of ore have been disclosed in the Somera claim and in the lower workings of the old mine.

The latest news from the Santa Gertrudis mine at Pachuca is to the effect that the lode has been developed on the 19th level for a length of 1650 ft., and that the ore is profitable over the entire distance. Two new veins south of the main lode have been found on this level, and the average value of the ore so far disclosed is \$25 per ton. It is not clear, however, whether the 19th level makes as good a showing as the 17th and 18th. At the old Camp Bird mine, in Colorado, a large vein, containing 3 ft. of \$25 ore, has been cut on the 6th level, but, judging from past experience in the deeper portion of this mine, no great expectations are warranted.

The decrease in the known resources of the Esperanza has caused disappointment, but it is in harmony with the forecast made by Mr. H. A. Titcomb a year ago.

RUSSIA.—At the Atbasar the developments in the mine continue good. The machinery for the smelter and railway is being assembled at Djoosalee, on the Tashkent railway. The talk of a consolidation of the Spassky and Atbasar companies is an intelligent anticipation of events; the consolidation, of course, will be a family affair, as the control of both companies is already identical.

The gossan outcrops in the Lake Baikal district, undergoing exploration in the interest

of the Siberian Syndicate, are giving promise; one of two shafts has penetrated the limonite and has cut rich sulphide copper ore. The manager, Mr. Charles A. Vaux, is expected in London.

INDIA.—The yearly report of the Nundydroog company confirms the progress reports issued during the past year, and mentioned in our columns, to the effect that recent developments have not kept pace with the extraction. The mine passed through a lean zone a dozen years ago, and some of its neighbours have had similar experiences. Charles H. Richards, who followed his father, Thomas Richards, in the management, writes more cheerfully about the latest work at 3050 ft. in Kennedy's section, and at 2900 ft. in Richards' section. Nevertheless, the directors have considered it advisable to reduce the monthly tonnage from 8300 to 7500.

The original mine in the Kolar district, the Mysore, is still the most important, and it continues on its uninterrupted way, still breaking records, after a life of 28 years. The yield of gold for 1912 was £904,079, just a trifle better than the previous highest in 1909, 1910, and 1911, and bringing the total since the start to £14,376,720. The amount distributed among shareholders was £381,250, or at the rate of 125%. This is not actually the highest dividend, for during the years 1904 to 1908 the distribution averaged £40,000 more; but it has to be remembered that in those days the money for extra equipment and the sinking of new shafts was obtained by the issue of new capital. The mine continues to respond to development, and during the year the reserve has been increased by 37,629 tons, standing on December 31 last at 1,337,998 tons, or 4 years' supply. Much money is to be spent during the next two or three years on the further sinking of the Edgar and McTaggart vertical shafts, and also on tube-mills and cyanide plant for treating the accumulated sandy tailing. Negotiations are in

hand for the acquisition of additional ground on the dip from other holding companies belonging to the same group.

CORNWALL.—The Dolcoath report for the half-year ended December 31 provides several 'records.' The amount of ore treated (60,631 tons), the total receipts (£119,487), the profit (£46,569), and the average price received per ton of concentrate (£137. 10s.) are all the highest; while, on the other hand, the yield of black tin per ton is the lowest, being only 32 lb. The reduction in the working cost per ton from 25s. 3d. to 21s. 1d. is welcome; it is due chiefly to the greater amount of ore raised, and also to the efficiency of the new hoisting and crushing plant. The report of Mr. R. Arthur Thomas confirms in detail our statement made last month to the effect that developments at depth are disappointing.

The Carn Brea and Tincroft has also a tale to tell about a record low content of the ore mined during the latter half of 1912, the figure being 21 lb. black tin per ton. Mr. E. S. King, who has introduced so many wholesome reforms during the last eighteen months, and provided the funds therefor out of revenue, at the same time earning a divisible profit for the shareholders, has not had fortune on his side in the way of useful discoveries of high-grade or even medium-grade ore. What would have happened to the mine if the price of tin had not been maintained continuously at a high level, is more than even Mr. King would care to contemplate. However, the yield per ton is greater than that of two other active mines, namely, East Pool and Falmouth Consolidated.

The South Crofty is also passing through a period of disappointing development, and at the meeting of shareholders, both the chairman, Mr. Francis Allen, and the manager, Mr. Josiah Paull, had the uncomfortable duty of confessing that, in spite of vigorous exploration, the ore recently disclosed had been of low grade. The returns for 1912 showed a

decrease in the yield of all the metals, tin, wolfram, and arsenic. The presence of specular iron has caused trouble in obtaining a high-class wolfram concentrate, but Mr. Paull has been able to remedy this. The high price of tin was sufficient to maintain the total yearly profit.

MALAYA.—The Tronoh tin mine suffers periodically from heavy rains and consequent landslides, and in spite of the exertions of such an experienced engineer as Mr. Harry D. Griffiths, the output consequently falls. It is now passing through such a period of depression. During the last six months the monthly output has been decreasing, and whereas the yield of tin concentrate in August last was 280 tons, it was only 130 tons in February. In November a serious fall of ground was recorded, due to the rain, and another occurred in January. The report for February shows that the heavy rain continues, and that the landslides recorded above still interfere with operations.

In our November issue we mentioned the work being done by the Malayan Tin Dredging Co., with a Payne dredge, in the Kinta district of Perak. The results obtained have proved so satisfactory that two more dredges have been ordered, and the necessary money for their purchase has been provided by the issue of 25,000 new £1 shares.

PERU.—Sluicing at the Aporoma gold gravel mine, in southeast Peru, started regularly on February 24, after a preliminary trial in December. A cable received on March 3 showed that 42,500 cubic yards had yielded 318 oz. worth £1300, or 7½d. per yard. Mr. G. Allen Crane reports that he has sufficient water-supply to maintain this output, but recommends the expenditure of £2500 in raising the dams so as to increase the available water. It will be remembered that the plant was all in position a year ago, but that an unusually dry season postponed the commencement of operations.

EDITORIAL

OUR COMPLIMENTS to the Minister of Mines in British Columbia for so prompt a publication of mineral statistics. Not many mining departments issue their annual review within a month of the close of the year. A summary of this timely information is given on another page.

REFORM in the method of selling Cornish tin concentrate appears to be within sight. Mr. E. S. King, for the managers, and Mr. Gilbert Pearce, for the smelters, publicly discussed the subject at the last Ticketings, and eventually a committee of five managers was appointed to confer with the smelters.

IN REGARD TO a paragraph in our last issue referring to the Bullfinch Proprietary, we learn that the use of the term 'wild-cat' has given offence. It was employed by us in the sense in which it is generally employed in Western America, as a synonym for a risky venture. An American operator talks about 'wild-cattng' when he takes options on claims in a new district. As the Bullfinch Proprietary has a reserve of ore, to treat which the mill has been erected, we withdraw the term 'wild-cat,' and regret the use of it in the paragraph mentioned.

THE REMARKS made by Mr. H. F. Marriott in discussing the Homestake paper of Messrs. Clark and Sharwood, read before the Institution, have been re-printed in several technical papers: and they were well worthy of the compliment. Although late in the day, we may point out that while the Black Hills and the Rand may present many features of resemblance, they are unlike in their winters. The deep snow-fall and protracted

cold weather of South Dakota present a condition having an important effect upon the economies of mining.

OBJECTION was made, at the Globe & Phoenix meeting, to the presence of a stockbroker on the board of the company. This is a proper objection. Obviously brokers and jobbers, those who deal in shares, for themselves and others, should not have first access to information from the mine. If honourable men, it places them in an awkward position as regards their advice to clients; if not honourable, it gives them chances to misuse information at the expense of shareholders. In any case, brokers and jobbers are unlikely to have the qualifications required for properly administering the affairs of a mine.

OUR ENERGETIC contemporary *The Financial Times* celebrated its 25th anniversary on February 13. We tender hearty congratulations. The leading financial daily newspaper of London shows no signs of decadence. In the matter of the East Rand, Anglo-Continental, and other lapses from proper conduct in mining affairs, it has given timely warning and effective advice. The correspondence from Johannesburg is particularly good. In many directions *The Financial Times* has shown praiseworthy independence and has been enabled thereby to do an important public service. We hope it may live long and prosper.

SOME DISCUSSION has taken place in the press recently with regard to the disposal of tailing resulting from the sluicing operations in Nigeria. The Government some time ago indicated certain rivers as permissible

sludge-channels,' and gave owners of properties below a right of redress. But these rivers are not large, and except at flood-time are not capable of carrying much debris. It is probable that when extensive sluicing operations commence, the tailing question will become acute. Already schemes are being considered for stacking tailing, as is done in other alluvial districts.

LORD CLIFDEN is to be complimented on the courage and sagacity exhibited in his offer to provide the necessary capital required for the new crushing and concentration plant at the Carn Brea & Tincroft. An enlightened landlord and owner of mineral rights, he is fortunate also in having an excellent agent in Mr. John Gilbert. It was due to these two gentlemen that the clearance was made two years ago, whereby a modern mine-manager, Mr. E. S. King, was brought to the rescue of an old but still promising tin property. Mr. King has won his spurs, and has shown what improvements and economies he could introduce, even with the miscellaneous collection of antediluvian rattletraps passing as a mining plant. Now his backers are willing and anxious to provide him with a proper equipment. Would that some other ground landlords took so direct an interest in their possessions and had so keen a sense of their responsibilities. As the farmer in one of Du Maurier's pictures in *Punch* said at the tenants' dinner, when proposing the toast of the evening: "If some landlords would do as our landlord do, there would not be so many of them as do as they do do": halting language no doubt, but eloquent of purpose.

BY the annual publication of that useful book of reference, 'The Directory of Directors,' we are reminded again that the duties of a trustee are assumed too lightly by sundry gentlemen of whom a larger sense of responsibility might reasonably be expected.

In 1912 seventeen men held 20 or more directorships in various companies. This scattering of attention is incompatible with efficient service and quite opposed to a serious acceptance of the duties devolving upon a trustee. However, even this anomaly is less glaring than it used to be, for the time was, not long ago, when as many as 40 directorships were held by several individuals playing the part of financial administrators.

INTEREST in the proceedings at the monthly meetings of the Institution of Mining and Metallurgy would be greatly increased if the president or secretary would announce in an audible voice the names of the several speakers. As it is, the whispered inquiry is heard along the benches: "Who's this?", only too often to be answered by "Don't know." We heard this query propounded at the last meeting, when Sir Thomas Holland, Mr. James Mackintosh Bell, and Mr. Lewis T. Wright addressed the meeting. The scope of the Institution covers the whole world, and the mining engineer is necessarily a nomad. Consequently, on his return home, he may not be acquainted with the personal presence of many distinguished men whose names and records are household words. We venture to suggest that the presiding officer at the Institution meetings should bridge this gap for us whenever possible.

THE LAW of extra-lateral right, though founded on the principle of justice to the original discoverer of an ore deposit, is apt to act preferentially toward the lawyers and the expert witnesses. The very mention of the name evokes visions of interminable lawsuits. We have, therefore, nothing but the sincerest congratulations to offer to the Le Roi No. 2 and the Consolidated Mining & Smelting Company of Canada for their wisdom in effecting a compromise in connection with the conflicting rights arising from their adjoining groups

of claims at Rossland, British Columbia. The disputed ground lay in the Le Roi No. 2 property and it was claimed to belong to the Le Roi property, purchased a year ago by the Canadian company. The necessity for some such readjustment of interests was fully known to the directors before the Le Roi property was sold to the Canadian company, and the directors of the Le Roi No. 2 were therefore not unprepared. Le Roi No. 2 transfers portions of the No. 1 and Josie claims, together with certain underground rights, to the Consolidated, and in return acquires the Monita claim. The possession of the latter ground will greatly facilitate the development of ore-bodies in the northern end of the Le Roi No. 2 property.

WE ARE continually protesting against the writings of untechnical men on technical subjects, and drawing attention to the absurdities and solecisms unconsciously committed. But it is hopeless to pursue a campaign for accuracy, if men of high standing in the profession continue to make similar egregious errors. A case in point is provided by Mr. Louis D. Huntoon, now a consulting mining engineer in New York, and recently professor in Yale university. He states in the 'statistical number' of the *Engineering and Mining Journal* that "H. F. Marriott is responsible for the introduction on the Rand of a preliminary discarding of waste rock from the mine ore by hand. The first mine to adopt this method was the Village Main Reef." All of which goes to show that our American friends are not as well acquainted with mining practice in other countries as they should be.

THE BANQUET celebrating the 21st birthday of the Institution of Mining and Metallurgy was worthy of its coming-of-age. More than 300 persons were present. The president, Mr. Edward Hooper, was supported by the Lord Mayor and Sheriffs of Lon-

don, besides sundry notabilities in science and industry. In his speech the Lord Mayor gave 91 millions sterling as the estimated value of the world's gold production in 1912. We wonder where he obtained his figures; they are probably correct within £4,000,000, as is indicated by the article on that subject appearing on another page. In his speech he referred to the expectation that the Institution would be granted a Royal Charter. This matter was also prominent in the speech of the President, who, after a felicitous reference to the service done in the early days of the Institution by *The Mining Journal*, of London, proceeded to express the hope that His Majesty in council would accord a charter whereby the useful work of the Institution might be furthered. This hope was echoed in every subsequent speech. Assuredly, if the granting of the charter can aid the good work now being done for the mining profession, it is time that it were bestowed. The Institution has won its spurs. It deserves official recognition, such as would be accorded by the grant of a charter. When chartered it would have a legal status and become empowered to sue those who claimed membership falsely; it would, in the eyes of many, gain in dignity, and be in a better position to adopt a disciplinary attitude in professional affairs. We hope the charter will come in due course.

IN A RECENT issue we mentioned that Mr. Ben Howe had introduced a new gold-extraction process for treating the refractory gold ore at the Gwalia Consolidated mine in West Australia, and we now have pleasure in reprinting in our *Précis of Technology* a paper by Mr. Howe describing the process and the methods for testing its applicability. The ore is finely ground, mixed with a small proportion of salt, and roasted at a temperature about 1000 C. The gold is volatilized as chloride, and many other constituents of the ore are also liberated. The fume is drenched with

water, and the solution thus obtained contains the reagents required to precipitate the gold as a fine powder, which is recovered in a filter-press. We take it that this process will only be effective economically if the gold is in a fine state of division. This is the form in which it exists when disseminated throughout pyrite or other sulphides. The details of the process are described by Mr. Howe in his paper, which is a model of lucid writing. The Gwalia Consolidated ore has proved a stumbling-block to metallurgists for the last few years, because it is not only refractory but low-grade. In consequence of its low tenour the usual West Australian practice was inapplicable, for the first cost of the plant and the current cost of treatment would have been too high. If the success that appears to be in store for the chloridizing-volatilization is realized in practice, the method will be attractive for the treatment of ores of high, as well as of low, grade. A process based on similar principles, known as the Pohle-Croasdale, was tried in Denver ten years or so ago, by the Metals Volatilization Company, and we believe that its failure was due to the employment of a reverberatory hearth with rabbles, and to the use of too low a temperature.

WE NOTE with regret that Mr. W. H. Storms, State Mineralogist of California, has been compelled, by the exigencies of a pitiful sort of local politics, to resign his position, for which he was so well qualified and in which he was doing good service to the State. The Board of Trustees, which includes a number of mining men of the highest standing, has supported Mr. Storms, but it appears that the Governor, Mr. Hiram Johnson, prefers to regard the appointment as part of the spoils of office. By dismissing two incompetent protégés of the Governor, the State Mineralogist incurred his hostility, so he is replaced by a worthy young man who belongs to the same Greek-letter fraternity as the

Chief Executive. The result is unfortunate. No man of any standing is likely to take the post, despite its sonorous title, so long as it involves servility to a politician, even if he does pose as a reformer. The episode is regrettable. California is a great mineral region and deserves to have a bureau of geological exploration. Yet the office of State Mineralogist has been disgraced, time and again, by all sorts of pettifogging political chicanery and pitiful graft of a kind only too familiar in a State that until lately was boss-ridden and railway-controlled. We had supposed that the reform movement, of which Mr. Johnson was a leading exponent, would turn over a new leaf, but apparently that is too much to expect.

HEALTH CONDITIONS have a direct bearing upon the economics of mining. Therefore we appreciate the investigation made by Mr. Samuel Evans, the chairman of Crown Mines. He has just been to Panama to ascertain why and how that locality, once notoriously insalubrious, has been rendered healthy by the work of the American Canal Commission. We do not wonder that any thoughtful participant in the operation of mines in South Africa should want to get the latest hints on sanitation, for the statistical comparison is significant. The record of mortality per thousand is quoted herewith:

	Panama	Transvaal	Rhodesia
1906	45'53	33'11	61'5
1907	29'61	31'71	57'6
1908	9'24	31'22	45'2
1909	7'91	32'18	42'7
1910	8'39	30'85	44'47
1911	8'25	29'50	28'62

Even allowing for a reduction of about 25% in the Transvaal and Rhodesia figures, owing to a different method of calculation, as against Panama, the greater salubrity of the Canal zone is remarkable. Mr. Evans concludes, from the work done by Colonel Gorgas and

his staff, that attention to the housing, clothing, and feeding of the workers, or even improvements in their working and living conditions, is insufficient to combat disease. Not only is the mosquito the bearer of yellow fever and malaria, but fleas on rats spread the bubonic plague, and flies disseminate typhoid and other intestinal diseases. The fight against insect-borne diseases must be waged by exterminating the insects themselves. This is a lesson that must be learned in every mining camp and industrial centre.

MINING ENGINEERS generally ought to make an effort to attend the Geological Congress assembling in Canada during August of this year. The meetings will be at Toronto, but the chief feature of the Congress will be the numerous and varied excursions to numerous localities of geologic interest, including the principal mining districts of the Dominion. The word 'geological' may tend to keep some of our friends from attending this convention, in the belief that it will deal with matters largely outside their immediate sphere of knowledge. This misapprehension must be dismissed, for one of the dominant purposes of the Congress is to exemplify and elucidate the application of geologic research to mining operations. The idea has been cordially endorsed by the principal mine-owners, all of whom have promised to extend the utmost hospitality, including facilities to examine lode-structures underground. Special trains and special boats are being chartered for most of the excursions. The Government, the Geological Survey of Canada, and the Canadian Mining Institute, are sparing neither trouble nor money in preparing for the meetings and the excursions. Even the Yukon is to be visited, besides, of course, Sudbury, Porcupine, Cobalt, Nova Scotia, and other localities celebrated for their mineral products. And everything is being done to spare expense to the visitors, not the hosts. It

will be a long time before mining engineers will have another such chance to make a tour throughout the length and breadth of Canada under conditions so pleasant socially and so instructive technically.

THE POSTMASTER-GENERAL, answering a question in Parliament, stated that the number of subscribers on the Post-Office telephone in London was 81,381. No separate account had been kept, so he said, of the number of complaints from subscribers, but 17,126 letters had been received during the year in connection with accounts for local services. We feel confident that the number of complaints must far exceed the number of telephones, for a more irritating and inefficient service it would be difficult to imagine. It is not surprising that the number of subscribers is so small, for the 81,381 in London compares with 123,405 in San Francisco, and London has a population about 14 times larger than the City by the Golden Gate. As an aid to business and as an instrument of social communication, the telephone service of London is a pitiable fiasco. We hope our representatives in Parliament will shame the Postmaster-General into a real effort to improve what is elsewhere esteemed an essential of modern civilization.

THE SCANDAL arising from the careless bestowal of honorary degrees by the University of Bristol serves to direct attention to the fact that such an honour means little unless accompanied by a mention of the grantor university. It reminds us also of the absurdity of speaking of the new president of the United States as Doctor Woodrow Wilson. Of course, as a distinguished educator and as the president of Princeton university he has received doctorates of laws and of philosophy from a number of universities. Again, as Governor of New Jersey it is more than probable that he would receive an honorary degree

from the State university, if he had not already received the distinction. The daily Press speaks of him as Dr. Wilson, as if he were a physician. Messrs. Taft and Roosevelt have received honorary degrees, several of them, and by the same token they also should be addressed as Dr. Taft and Dr. Roosevelt. Indeed the use of doctor as a title is a silly provincialism. It is an honour if granted by certain universities; but an absurdity when accorded by others. It is an honour, to be recorded as a suffix; not a title, to be expressed by a prefix. Why not call a Master of Arts, Master Jones; or a Bachelor of Arts, Bachelor Smith? Because there are so many of them that the handle to the name would be without significance. The same argument applies to the doctorate, when disjoined from the grantor university.

THE ENGLISH INCOME-TAX of 1s. 2d. in the pound rests oppressively on the foreign investor in mines outside the United Kingdom. The directors of the Mexico Mines of El Oro, Limited, have taken steps to avoid this impost on their Continental shareholders by transferring their head-office and the management to Paris, while retaining their organization under English law and their registered office in London. Since the control was wrested from the Exploration Company two years ago, the proportion of foreign holdings has continuously increased. Moreover, the majority of directors are Frenchmen, and the board meetings have been held in Paris. According to the celebrated De Beers decision, the domicile of a company is the place where the controlling brains are gathered together. The De Beers company is registered under the laws of the country in which the mine is situated, and a large proportion of the shareholders are residents in Continental countries. Nevertheless, because the policy was controlled by men having their domicile in London, the company was declared by law liable

for English income-tax on the whole of its profits. The Mexico company is in a position to take advantage of the same principle in a different way and is able to draw attention to the vagaries of English company law.

IN THE DISCUSSION as to the relative advantages as the vanning-shovel and chemical methods for estimating the metallic content, recoverable or otherwise, of tin ores, it is often stated that the chemical test *invariably* reveals a higher content than is indicated by the shovel. This is a hasty generalization that occasionally brings trouble in its wake, for the vanning-shovel catches other minerals than cassiterite. We may quote a recent case in point: A parcel of ore from a Cornish mine was sent for assay by both methods, and the vanning test gave a higher figure than the chemical assay. Investigation showed that a substantial proportion of the 'cassiterite' was chalybite, or carbonate of iron. If reliance had been placed solely on the shovel, it is obvious that the ore would have been supposed to contain much more tin than existed in fact, and that the purchaser of the property would have been the victim of one of the mischances of mining. Thus, in the future, the word 'invariably' must be carefully avoided.

A READER of the *South African Mining Journal* writes to that paper asking whether 'pennyweights' when abbreviated should be written 'dwt.' or 'dwts.' He quotes the usage of this magazine for 'dwt.' and that of the *South African Mining Journal* for 'dwts.' In reply, the editor of our contemporary at Johannesburg says: "Abbreviations have acquired plurals through custom and constant usage. For instance, one writes 1 oz. and 20 ozs. Where more than one pennyweight is in question we should always write pennyweights and abbreviate as dwts." To most of which we venture to demur. 'Oz.'

and 'dwt.' are apothecary's symbols for, not abbreviations of, 'ounce' and 'pennyweight.' "They have acquired abbreviations by usage," says our South African contemporary. What usage? Editors should lead, not follow, in the use of words. Some persons not wholly devoid of education have been known to speak and write of 'stratas.' Is this illiteracy to be standardized by careless editors? Who is to decide? It is stated that "*one* writes 1 oz. and 20 ozs.," but "we should always abbreviate pennyweights as dwts." The indefinite pronoun stands for the generality of people, but these have none of the discrimination required for a decision in such matters. 'We' stands for the editor of the *South African Mining Journal*, a gentleman who apparently cares about as much for precision as 'one.' A chimera ruminating in a vacuum would be as good an authority. Surely the best usage is that of people who apply an understanding knowledge of words to a loving care in the use of them.

IN WRITING, some time ago, concerning future sources of energy for industrial purposes, comparing the relative prospects of oil, coal, and water-power, we hazarded the opinion that the almost limitless resources of Scandinavia might at some distant day become a serious rival to coal in Great Britain, even at the industrial centres that have been founded and based on Britain's coal resources. Such an economic revolution is far enough away at present, for the transmission of electric energy in bulk by cable across a stormy sea is a problem that has not yet been seriously tackled. Nevertheless, the first faint dawn of a possible new era is to be seen in the project now in the course of realization for sending electric current from the Trollhattan waterfall, in Sweden, to Denmark by submarine cable. The occasion arose through the demand on the part of the municipality of Copenhagen for a reliable source of energy for its electric tramways.

This was at the time when the British coal strike stopped the delivery of fuel to the Danish capital. The new contract provides for the construction of a high-voltage transmission line from Trollhattan to Helsingborg, on the Swedish coast, a distance of 160 miles, and from thence by submarine cable across the Sound to Elsmore on the Danish island of Zeeland, a distance of 10 miles. A central distributing station will be erected at Elsmore, and current will be transmitted not only to Copenhagen, 50 miles to the south, but to other industrial centres in the island. The necessary consent on the part of the Swedish Government has not yet been obtained; the consent of the Danish Government may be taken as a matter of course.

Globe & Phœnix.

We attended the special meeting requisitioned by the recalcitrant shareholders. It lasted two and a half hours, of which the larger moiety was squandered in windy talk. Anything in worse taste than the speeches of Messrs. W. P. Dunlop and Gavin W. Ralston, on opposite sides, we never heard. The sophomoric rodomontade of the one was balanced by the reckless personalities of the other. Both speeches were a sheer waste of valuable time, and tended only to obscure the issue. Many were the herrings dragged across the trail. The directors defended their uncompromising attitude by referring to the abuse heaped upon them by their irreconcilable shareholders. The requisitionists excused their truculence by pointing to the toploftiness of the board. Neither gave way. The controversy by circular had to be ended by counting proxies. In the end, the directors were supported by 321,304 votes as against the 221,144 mustered by the opposition. To us, as onlookers, the directors do not appear to be either the conspirators or the imbeciles they have been painted in sundry circulars. The board is probably above the average in intelligence, and the chairman

is probably more capable and responsible than most men filling that onerous office. Their administration of the mine is probably as efficient as that of most mines, and considerably more worthy of support than that of most Rhodesian mines. They have had the bad luck to face a vigorous body of kickers. If the kicking had been done more tactfully, it might have unsaddled the board. As it is, they have kept their seat, but not without having to grasp the pommel in obvious timidity. As usual, the criticisms failed because the critics lacked information, especially on technical matters. It was amusing to hear man after man arise in open meeting and disown being an 'expert,' and yet presume to lay down regulations for the operation of a mine. Not a man spoke who could preface his remarks by stating quietly that, as one versed in gold mining, he ventured to offer brief comment. To the editor of a technical paper it looked like the blind leading the blind, or the lame undertaking to show the cripples how they should jump. The love for mere amateurism was exhibited in the objection raised to the spokesman for the recalcitrants. It was said against him that he had not been a shareholder long, and that he did not hold many shares. What of that? He was an advocate for more than a third of the shareholders in the company. Is the soundness of a man's argument in such a case dependent on the number of shares he holds or the length of time he has held them? On the contrary, shareholders usually cut a poor figure when they rise to plead their case in a crowded room. Obviously they should engage the services of a man trained for this particular kind of work. Do not litigants engage counsel to plead for them? Do not directors, who ought to know more about a mine than an average shareholder, retain a consulting engineer to advise them what to do? Why should a dissatisfied shareholder not be represented by a skilful spokesman? Indeed, the poor pre-

sentation of the grievances of shareholders is one reason why they usually receive such scant satisfaction at public meetings. It is a silly way of belittling a man's opinion to ask him how many shares he holds. The opinion should be weighed by the sense behind it, not the shares. Leave that to the Stock Exchange.

As we have said, the meeting discussed the working of rich ore, the sinking of a shaft, and other technical matters, without hearing from a single person versed in the questions at issue. Blunders galore were inevitable. Mr. Frederick A. Macquisten, the able advocate appearing for the Scotch insurgents, claimed that rich ore can be stolen; Mr. T. Blair Reynolds, the chairman, asked those present to imagine how a man can steal a ton of ore even if it assays £20 or £30 per ton. A mining engineer could have saved time by explaining that a ton of ore containing £30 in gold might have £25 of that £30 worth of gold in a few pounds of stuff. The present writer once extracted £600 worth of gold in two hours with an iron candlestick. Again, a lot of loose talk was made over the proposed new shaft and Mr. H. A. Piper's recommendations thereon. If the consulting engineer and the directors had accustomed themselves to recognizing the shareholders' right to full information, and if pains had been taken earlier to give that information explicitly and frankly, the misunderstanding on the subject among some of the shareholders might have been avoided, and would have been rendered wholly unreasonable.

The best speech, in reply to the frontal attack on the board, was made by Earl Russell. He confessed his repugnance to making a visit to the mine, as a director, at the company's expense, because he was insufficiently versed in gold mining. On the other hand, the new director, Mr. J. C. Pitman, expressed his intention to make such a visit of inspection, despite ignorance on technical affairs. The ab-

COMPARATIVE STATISTICS 1910, 1911, AND 1912.

Mine	Tons Milled			Total Reduction Cost				Average Value of Ore Milled		
	1910	1911	1912	1910	1911	1912	Last four months, 1912	1910	1911	1912
Modderfontein B	—	77,260	388,570	—	5s. 6.8d	4s. 2.4d	3s. 7.5d	Dwt. 10.68	Dwt. 9.05	Dwt. 9.05
New Modderfontein	534,300	574,600	548,600	4s. 3.5d.	3s. 8.1d.	4s. 1.9d.	3s. 7.5d.	7.07	7.52	9.27
Rose Deep	656,500	695,100	782,200	4s. 5.5d.	4s. 7.1d.	4s. 3.5d.	3s. 10.1d.	7.07	7.11	7.14
Goldenbus Deep	826,610	801,860	627,960	5s. 1.6d.	5s. 0.1d.	4s. 9.3d.	4s. 6.5d.	7.11	6.94	7.45
Nourse Mines	535,813	621,251	641,000	4s. 11.3d.	4s. 3.7d.	4s. 9.6d.	3s. 8.8d.	7.58	7.38	7.38
City Deep	—	349,713	479,630	—	4s. 11.0d.	4s. 3.1d.	3s. 8.3d.	—	7.67	8.75
Village Main Reef	493,300	476,250	470,056	4s. 9.3d.	4s. 10.8d.	4s. 8.5d.	4s. 3.8d.	8.92	9.32	9.71
Village Deep	507,800	569,500	596,900	4s. 8.5d.	3s. 6.8d.	3s. 7.8d.	3s. 5.6d.	6.19	6.81	7.20
Ferreira Deep	—	—	373,430	—	—	4s. 6.5d.	4s. 5.3d.	—	—	9.99
Robinson	638,900	592,700	577,300	4s. 7.3d.	4s. 4.0d.	4s. 2.4d.	3s. 11.9d.	10.50	11.31	10.48
Crown Mines	1,514,000	1,618,500	1,920,700	4s. 3.0d.	4s. 2.4d.	3s. 8.6d.	3s. 7.2d.	8.37	8.78	7.94
Bantjes	97,205	273,212	286,453	—	4s. 10.8d.	4s. 6.1d.	4s. 0.9d.	7.14	6.90	7.27
Durban Roodepoort Deep	240,530	262,540	293,995	5s. 3.8d.	5s. 1.9d.	4s. 3.6d.	4s. 0.3d.	7.48	7.36	7.50

surdity of this does not appear to be apparent to the shareholders. It is a waste of their money and a waste of a capable lawyer's time. Only an engineer who has been a mine manager is qualified to investigate the management of a mine. Such muddlesome proceedings are out of date. If anybody is to pass criticism on the points at issue it should be an independent engineer in good standing selected by unprejudiced persons. If the Globe & Phoenix directors will get a report from such a man, they may be able to justify all they have said against the disgruntled portion of their financial electorate.

Rand Metallurgical Progress.

Herewith we give comparative statistics exhibiting the metallurgical work done at the various plants belonging to the group of properties known collectively as the Rand Mines, Limited. The assay-value of the ore milled and the percentage of recovery therefrom are based upon the total ounces of gold recovered during the year *plus* the ounces lost in residue. The only exceptions are Modderfontein B for 1911 and Bantjes for 1910, in both of which cases, owing to the unavoidable absorp-

tion of gold by the plant during initial operations, the screen-assay has been accepted as the ore-value. The figures of cost cover all operations connected with reduction and extraction between the shaft and the dump, but they do not include administration or head-office charges. New Heriot and City & Suburban records are omitted, because these mines do not properly belong to the group. The figures speak for themselves. It is gratifying to note that the diminution of cost achieved in the three years has been accelerated during the last four months. Owing to the variation in size of the mines and in the conditions obtaining at the reduction works of this group, it is not to be expected that the average treatment cost would be as low as that attained by the five mines of the Consolidated Gold Fields group, namely, 3s. 8d., which is due largely to the exceptional capacity of the mills belonging to the Simmer & Jack, Knight's Deep, and Simmer Deep Jupiter companies. However, it will be noted that the New Modderfontein, Modderfontein B, City Deep, and Crown Mines can afford comparison with any of their neighbours. Taking the nine mines, the figures of which for

RAND MINES, LIMITED.

Actual Recovery			Total Residues.			Remarks
1910	1911	1912	1910	1911	1912	
%	%	%	Dwt.	Dwt.	Dwt.	
—	83.20	96.20	—	0.495	0.345	
96.37	97.36	97.59	0.257	0.199	0.223	First recorded month, October 1911
94.84	94.24	93.98	0.365	0.410	0.430	Expensive improvements charged to working cost in 1912
93.72	94.17	95.68	0.448	0.403	0.319	
94.90	94.92	95.89	0.387	0.374	0.303	
—	95.67	96.73	—	0.347	0.288	First recorded month, January 1911
94.21	94.76	95.09	0.518	0.488	0.477	
94.43	95.47	96.17	0.345	0.310	0.276	
—	—	95.97	—	—	0.403	Ferreira Deep, Ltd., and Ferreira G. M. Co., amalgamated in June, 1912
94.86	95.32	96.38	0.542	0.531	0.378	
95.44	95.41	95.32	0.383	0.404	0.373	
84.98	94.95	96.40	0.347	0.350	0.261	First recorded month, August 1910
94.67	94.38	95.04	0.410	0.413	0.373	

1910 are given in the table, and comparing the cost in that year with the cost during the last four months of 1912, it will be seen that a saving of 8d. per ton has been effected. Over the 6,750,000 tons treated in 1912, this saving represents an additional profit of £225,000. This is the result of persistent effort and watchful supervision, rendered effective by a high order of technical skill. We send cordial congratulations to the staff responsible for this achievement.

Arctic Exploration.

Again has the glamour of the Arctic, or Antarctic, exploration bemused our people. Again has the nation succumbed to a fit of sentimental hysteria. Of course, Capt. Scott and his comrades were brave men; of course, they died like sailors and gentlemen; but why not? So do most men face the inevitable when it holds them in its grip. Let us honour them, if you will, for living up to a tradition that we in our arrogance like to deem peculiarly British, but we need not embrace one another in a rhapsody of gush that robs a manly deed of all its simple dignity. As ordinary spectators of the histrionic game of

Polar exploration it seems to us fairly obvious that the tragedy of the South Pole was due to culpable negligence. The idea of trying to cover a long distance over the snowy wastes without the aid of dogs was a flouting of experience. Dogs furnish not only transport, but food, in case of dire necessity. The motor-sleds and Manchurian ponies were in the nature of amateur experiments. Both failed, as might have been expected. To take a cavalry officer, however brave, on an exhausting tramp over snowfields showed poor judgment. There was no need for taking these hazards; the expedition was not called upon to try experiments. Even the heroic apologia does not erase the blunder. It may be an unpleasant task to demur to popular enthusiasm, but to us it seems clear that the recent successful effort to begot realities with sentimentality is on a par with the treatment meted to an incompetent general such as Sir Redvers Buller, who, after several criminal blunders culminating in reverses that nearly ended in a national defeat, was allowed to retain his command and come home to receive a sword of honour from his admiring fellow-citizens at Exeter.

Polar exploration has always been unduly glorified. Of late, absurdly. Since the Northwest passage was found by Amundsen, and proved by him to be quite useless to navigation, the quest of the Pole has been a campaign of theatrical gymnastics. For every man who goes on such an expedition, at least a thousand volunteer. It is a grand-stand performance *in excelsis*, and hugely over-rated. Every winter scores of miners, with no elaborate equipment, in little more than their digging clothes, with no big store of provisions, but only a bare sustenance in the form of tinned food and salt fish, will go with their sleds and dogs all the way from Dawson, on the Yukon, to Nome, on Bering Sea, a distance of 1800 miles, without a hurrah or a newspaper paragraph. If 5 oz. gold ore were

announced to have been found at either Pole, a hundred prospectors would reach the spot within a year. Sordid, you say, is the greed for gold, and glorious, you say, is the placing of the flag a few degrees farther north or south. Each to his taste. The glamour of the Pole is largely based on a mythical notion that there is, or was, something there; that the axis of the earth protruded or that a big lodestone marked the neighbouring magnetic pole. That, and the recurrent tragedy of wasted human life, has fired the imagination of those that stay at home, but to anyone who has been within the Arctic circle the bathos of the performance is plain.

Not that we would forego the stimulus of great adventure or the example of resolute purpose heroically fulfilled. It is a question of mental focus. Perspectives vary. To us the world is full of heroes: the men that go down in submarines, the miners that penetrate into gassy coal-workings, the air-men pioneering a new field of invention, the doctors and nurses fighting a contagious disease, and most of all the women, who, for the sake of the home and the race, go willingly into the valley of the shadow of death. Such as these make Peary and Cook, Shackleton and Amundsen, look like tinsel performers on a lime-lit stage. Again, the gallant sailor whose tragic end has called forth so notable a demonstration was honoured in his obsequies by the presence of the King, himself a sailor. That is well; but when Lister was buried, His Majesty was not present. The absence or the presence of the Sovereign was in accord with the sentiment of the crowd. Yet, when Lister died the King lost his greatest subject; the world, its noblest citizen. The life-work of Lister did so great a service to humanity that it is difficult to imagine a greater; compared to it, the pseudo-scientific efforts to reach an imaginary geographic point on the earth's surface are as the fife and drums of a passing band to the lordly diapason of an organ rever-

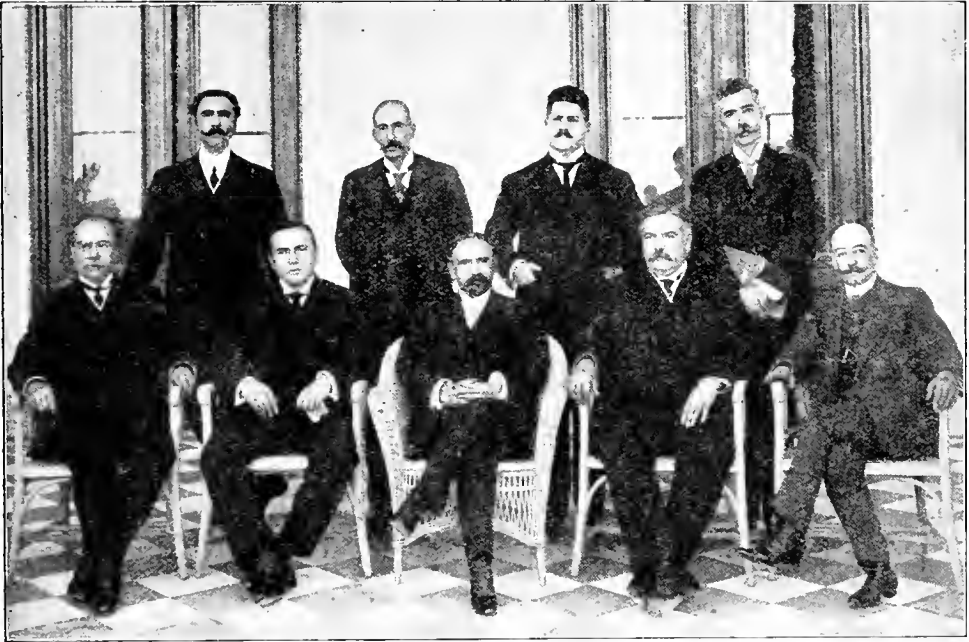
berating in majestic gladness to the uttermost aisles of time.

The Mexican Melodrama.

At the time when we went to press last month the city of Mexico was the scene of an artillery duel between the troops of the Government, headed by the President, Francisco I. Madero, and the insurrectionary force commanded by Felix Diaz, a nephew of the former president, Porfirio Diaz. This latest phase of Mexican turmoil began on February 9. After some preliminary skirmishes, the force commanded by Diaz took possession of the Arsenal, while the Government troops occupied the National Palace. Forthwith began an intermittent fight, with rifles and artillery, across the streets of a thickly populated city, without any apparent regard for the lives or property jeopardized. This fight, more deadly to the innocent onlookers than to the participants, continued until February 18, when General Huerta, the commander of the Federal army, turned against Madero, and, having arrested him, compelled him to resign the presidency, which was then assumed by Huerta. An armistice between the factions previously engaged in turning the capital into a battle-field was followed by a coalition, the temporary presidency of Huerta being recognized by Diaz and his supporters. The most forceful and least popular member of the Madero family, namely, Gustavo Madero, the late President's brother, was captured by an act of treachery and subsequently assassinated in the approved Mexican way, by being shot in the back while supposedly in the act of escaping. On February 20 the soldiers of Diaz, led by himself in civilian attire, made a triumphal entry, acclaimed by the crowd, which was only too glad to see some prospect of peace. Two days later at midnight Francisco Madero, the constitutional President, and Piño Suarez, the Vice-President, were shot during a supposed attempt at rescue when they were being

taken from the National Palace to the Penitentiary. This assassination, even if not ordered or instigated by General Huerta, is a dirty business. It affords a fitting climax to the destruction of constitutional government in Mexico; for while Madero won his way to power by insurrection, he did not revolt until his legitimate candidacy had been stopped illegally by Porfirio Diaz. Moreover, Madero, after a successful revolution, was endorsed at

are blowing with renewed cheerfulness. The performers in the late unpleasantness have put on clean uniforms, and now call upon the world to see how they restore Mexico to peace and tranquillity. It is not convincing, but nothing in Mexican politics is convincing, so we take them at their word, for the moment. A provisional government has been formed, with some promise of public support during the interval that must elapse before another



THE LATE PRESIDENT MADERO'S FIRST CABINET.

Pino Suarez

Ernesto Madero

Manuel Calero

Francisco T. Madero

Abram Gonzales

a general election, through which he became the constitutional President. The overthrow of his government was not effected without street-fighting involving 2000 lives, and the wounding of about 8000 citizens, mostly non-combatants, and then a final series of assassinations that brought the curtain down on another act in the sordid tragedy of Mexican misrule.

Since then the curtain has been raised and the drama resumed. The dead and wounded have been carried off the stage. The bugles

general election gives Mexico an executive having some show of legal authority. In the interim government are Señor De la Barra, who was provisional president after Porfirio Diaz was deposed in May, 1911, and Rodolfo Reyes, the son of General Bernardo Reyes, who would have figured prominently in the recent vendetta if he had not been killed in one of the early attacks made on February 9. Conditions outside the capital are improved by the expressed willingness of Pascual Orozco, the rebel leader in the North, and of

Enehano Zapata, the chief bandit in the South, to support the *de facto* government. An amnesty is to be granted to all political offenders. The treasury is empty and a big loan is to be issued, partly, no doubt, to be used in the payment of indemnities. Thus the prospects of reasonable quiet have been improved at the expense of all pretence at representative government. Mexico has proved herself unequal to the forms of democracy. It remains to be seen whether a return to a military despotism will give her political stability. We doubt it, but we are glad to learn that those interested in Mexican business are optimistic, believing that they will now be free from the molestation of brigandage and the interruption of railway traffic incidental to guerrilla warfare.

The precedents are not particularly auspicious. Between 1821, when she finally rejected the Spanish domination, and 1876, when Porfirio Diaz began his long despotic rule, Mexico had 52 dictators masquerading as Presidents, one Emperor, and a Regency. Most of these rulers came and went in bloodshed, varied by anarchy. The unhappy Maximilian left a legacy of unrest, never suppressed and only controlled by the iron hand of the elder Diaz, whom Madero overthrew in a vain effort to establish some sort of representative government. Madero failed because he was an impracticable sentimentalist, unable to win the support of the better class of his compatriots. Lacking such support, he filled the offices of State with relatives. Madero was nepotic: Diaz, despotic. The retrospect is not cheerful, and it never will be cheerful until the better class of Mexican awakens to some realization of his duties as a citizen. The small minority of educated people in the country has held itself aloof, too supine to take part, too timid to interfere. That is the trouble with Mexico. As for the assassinations and murders, they are disgusting, of course, but they constitute an essential part of the game

as played in Spanish-Indian countries. It is the code of the bull-ring and the amphitheatre. *Habet!* Thumbs down! Those that play at the revolutionary game must pay the forfeit. If that forfeit is rigorously exacted, the attractiveness of insubordination may be diminished. Indeed, the biggest mistake made by Madero was his failure to sign the death warrant of Felix Diaz after that unruly soldier had been sentenced by court martial, on the collapse of his revolutionary effort at Vera Cruz, last October. In consequence he, and not Diaz, was the first to die.

Editorial Ethics.

The investigation undertaken by the Marconi committee, while exposing several mare's nests, also served to develop one or two interesting points in journalism. This Parliamentary committee was appointed to investigate vague charges involving the participation of members of the Government in the share speculation arising from the contract, for a service of wireless telegraphy, between the Marconi company and the Post-Office. It was suggested by sundry newspapers, opposed politically to the Government, that even Cabinet ministers had been guilty of share dealings rendered successful by the use of official information. The *National Review* and *The Outlook* were the leaders in this campaign of defamation by innuendo. A well-known financial journalist, Mr. W. R. Lawson, contributed a series of articles to *The Outlook* reeking with sinister suggestions involving the integrity of men highly honoured in the Government of the day. When brought before the committee, he had to acknowledge his inability to give proof, and, under cross-examination, he finally withdrew the whole of his unsubstantiated charges. Yet the editor of the paper publishing these concoctions disowned responsibility, taking the position that if proof were necessary for such charges, then political journalism would be impossible. This we dis-

miss without comment. Next came Mr. L. J. Maxse, the editor of the *National Review*. With a sneer at Mr. Lawson's abject confession, he repeated the insinuations of corrupt dealing on the part of Ministers, but avoided direct libel by mentioning no names and denying that the word 'corruption' was properly applicable to the case. On being asked to give evidence for his implications he refused, saying that it took the form of confidential letters. Such letters he would not produce, nor would he give the names of the persons supplying him with the loose information on which he had based his scurrilous attacks. Some of the correspondence he had destroyed and all of it he withheld on the ground that an editor cannot in honour disclose communications made to him confidentially. Of course, *The Times* came to his rescue, for it had behaved similarly in the case of the Piggott forgeries. A vigorous controversy ensued, coloured unfortunately by political prejudice, so that the ethical issue was smothered in partisanship. However, the point is important, and we shall discuss it in its bearing upon the technical journalism of today.

It is true, an editor receives a good deal of information confidentially, and under promise not to divulge the identity of his informant. Such information may give him a clue to current events, but he cannot base personal charges upon it. Before he does that he must get corroborative evidence of a quotable character, not only as a means of self-defence but in justice to the persons or company affected. Without such supplementary inquiry, the editor becomes the victim of the first spiteful tongue that takes the trouble to talk to him. He must hold himself aloof from mere gossip, preserving as far as possible the judicial attitude of a critical onlooker. No charge involving a man's honour should ever be made without the fullest proof, and proof susceptible of being published, on demand. The editor must be prepared to substantiate

his charge, or to withdraw it, with an apology, when challenged. In any event, we deem it had sport to make charges by innuendo; if, in the public interest, it becomes necessary to make a charge, then names should be given, so that those attacked may have a chance to defend themselves. Otherwise, they cannot hit back without giving the impression that the cap fits, as it were: that they recognize the description of wrong-doing as applying to themselves. It is poor journalism to make a cowardly attack, affording no chance of defence on the other side; it is poor journalism because sinister implications are not nearly so interesting as a straightforward criticism that states the names of the persons or parties involved. The purpose of journalism should be—our purpose is—to afford such a criticism of current events as will create a healthy state of public opinion on specific subjects. Our subject is mining and our purpose is not to be sensational at the expense of other men's honour, but to be useful by affording fair, because detached, comment on mining affairs, in the hope that the industry may be benefited thereby.

By the Way.

In the pages of *The Spectator*, that eminently respectable expression of early Victorian sentiment, we find a weird and recklessly Ruskinesque diatribe on gold mining. It is based upon Mr. Stephen Graham's observations of the miserable settlements alongside the alluvial gold diggings in the Urals. Having been in that part of Russia ourselves, we are not inclined to question the accuracy of the description, but we protest against the silly generalization that because a horde of Russian peasants live and die like beasts of the field therefore "gold mining is a sort of rape, a crime by which earth and man are made viler." Such stupid exaggeration is unworthy even of the toothless ferocity of *The Spectator*; it goes beyond Carlyle in his most jaun-

deed mood, or Ruskin in his most violent fit of emotional exaggeration. No great trick of journalism is needed to depict the hop pickers of Kent as ministering to the bibulous greed of London, or the sole-fishers of Dover as the myrmidons of French restaurateurs. It would be as fair to take Piccadilly Circus at midnight as an expression of modern civilization or a suffragette raid as an example of political progress. The savage sentimentality of Mr. Graham involves a manifest economy of truth. He is weeping over the wrong tombstone. "The earth and man have" not "been made viler" by gold mining. On the contrary the earth has been explored, exploited, and made habitable by the exertions of the prospector, the digger, and the miner. The imperial diadem of Great Britain owes its brightest jewels to gold-mining adventure. It was the seeker after the precious metal that traversed the plains and forests of western America, blazing a trail for Canadian industry. It was the miner that conquered the arid wastes of the Australian hinterland and gave Britain another fruitful continent. It was the prospector that carried light into the darkest parts of the jungle and laid the foundations of an African empire far greater than that annexed by Carthage or by Rome. It is ignorance, sheer ignorance, to depict the miner as a mere grubber after gold, and mining as merely a counter for unhealthy speculation. The petty self-complacency of middle-class opinion as expressed by such a belated anachronism as *The Spectator* is wearisome. It is parochialism gone mad. Not even Macaulay's schoolboy is needed to tell a suburban editor that mining is one of the two basic industries of mankind, and that gold mining in particular has been the forerunner of civilization, the herald of empire, and the pioneer of industry, for a time at least as long as that which separates the *Spectator* of today from the greater *Spectator* that was founded by Addison and Steele in the expansive days of Queen Anne.

Gold Production.

The statistics of gold production in the chief contributing regions are now available, so that, with estimates for the minor producing countries, it is possible to give a fairly close approximation to the total output of the world in 1912. The official records and the necessary estimates are given herewith.

The Mexican government publishes its mineral statistics for the year ending on June 30, therefore we are compelled to estimate the output of gold for the calendar year. All annual figures for Mexico given by other authorities are similarly subject to this measure of approximation. The last official Russian figures are for 1910, namely, 3467½ poods or 1,823,905 ounces of gold, worth £7,767,200. The output from Madagascar is given by the French government in ounces; the last statement is for 1911; no later figures are available.

It will be noted that 85% to 90% of the entire world's production can be stated with reasonable accuracy. The remaining 10% to 15% is a matter of guess. In some cases no accurate data are ever available; in other cases the official figures are always so late in being made known as to be useless for a prompt review of the subject. In regard to a number of minor gold-producing countries, the statistical authorities have to guess twice and divide by two in order to arrive at the figures appearing in their statements. An air of spurious accuracy is imparted to such rough estimates by stating them in impressive detail. That we deem it undesirable to do. Instead, we have taken the data of the United States Geological Survey for these "other countries" in 1911, and, after reducing from dollars to pounds sterling, we give a round figure.

As regards 1912, we have official data from the African and Australasian mining regions, and we also have accurate figures for the United States, India, and parts of Canada. The estimates for Mexico and Russia will not be far out. As regards one-tenth of the total

output, no figures are available and no accurate estimate can be made. For instance, among the "other countries" are France, Colombia, Brazil, Guiana, Central America, Japan, China, Korea, and the East Indies. Of these, France, Guiana, Japan, Korea, and the East Indies will give reliable statistics later in the year, but the Colombian, Brazilian, and Central American figures, even when published at a late date, belong to an-

vey credits China with \$10,000,000 in 1911. The roundness of the figure speaks for itself. Applying similar reasoning to the 1912 output, we find that the known output was £88,800,000, as against £86,200,000 in 1911. Including the minor gold-producing countries, the total production of the world was £98,500,000 in 1912, as against £96,000,000 in 1911. We avoid going into small figures; no exact estimate is possible.

PRODUCTION OF GOLD THROUGHOUT THE WORLD DURING 1911 AND 1912.

	1912	1911
Africa—		
Transvaal.....	£38,757,560	£34,991,620
Rhodesia	2,707,368	2,568,201
West Africa.....	1,497,179	1,069,442
Australasia—		
Western Australia.....	5,449,057	5,823,522
Victoria	2,039,400	2,138,000
Queensland	1,484,160	1,623,390
New South Wales.....	702,129	769,353
New Zealand.....	1,345,115	1,808,049
United States.....	18,826,110	19,895,270
Mexico	5,100,000*	6,020,000*
Russia	5,700,000*	6,601,000*
Madagascar.....	350,000*	368,088
India	2,265,094	2,150,050
Canada—		
Yukon.....	1,000,000*	943,200
Ontario.....	360,000	9,280
British Columbia.....	1,121,400	1,055,750
Other countries, approximate.....	9,700,000*	9,800,000*
	£98,500,000*	£96,000,000*

* Estimated.

other category. As for the Chinese output, that has always been a mystery, translated by statisticians into a guess, for two factors interfere with accuracy: it is never known how much of the gold credited to China is metal stolen in the Siberian mines and brought across the frontier; and it is never known accurately how much even of this gold is counted again in the other countries to which the Chinese migrate. The United States Geological Sur-

In reviewing these statistics, it is apparent that the increase of production is due mainly to the mines of the Transvaal, where a gain of £3,716,075 is recorded as against the world's aggregate gain of £2,500,000. Rhodesia has not more than held its own; West Africa has improved nearly 50%, but the total contribution is not large. It is less than that of several individual groups of mines. All the Australasian states exhibit a diminution

of yield, especially Western Australia and New Zealand. The near exhaustion of most of the big mines at Kalgoorlie explains the one fact, while the Waihi's trouble accounts for the other. In the United States the decrease is small and is due almost entirely to Nevada, which state yielded \$18,096,900 in 1911 and \$13,331,680 in 1912. This big drop is caused by the decadence of the Goldfield Consolidated, which, since 1906, has been the most productive gold mine in Nevada, but is now feeling the exhaustion of its rich ore. In Mexico the collapse of law and order has affected isolated mines to the extent of compelling them to shut-down. In the fiscal year 1910-1911 the output of gold, after eliminating foreign gold coined in Mexico, was £6,105,268, while in the corresponding period, July 1 to June 30, of 1911-1912, the output was £4,960,134. In Russia the Lena Goldfields is the chief contributor; hence the interruption to work caused by labour troubles, and the depletion of the richest ground, has affected not only the output from the Bodailo district but the aggregate production of the Empire. The Kolar goldfield, in India, continues to yield steadily and profitably. In Madagascar, native and French activity in alluvial mining is well maintained. In Canada, the Yukon owes the major part of its output to the operations of the Yukon Gold Company, which continues profitably to dredge for gold in the Klondyke watershed. In Ontario, the output of the Hollinger and Dome mines, at Porcupine, has caused a relatively large increase to be recorded recently. Thus the review discloses no remarkable expansion of production during 1912.

The Rand is not yet at the zenith of its productiveness, but near it. From Rhodesia we expect a gain during 1913, in consequence of the beginning of milling at the Cam & Motor, Shamva, Falcon, and Eileen Mannah mines. But some of this gain will be countered by the dwindling production from several proper-

ties now at the head of the active list. In West Africa, British enterprise is making a manly struggle, but no large increase of output is likely. The outlook in Mexico and Russia is not good, for the adverse causes felt in 1912 are likely to persist in 1913. As soon as the Government can promise safety to life and property in the outlying districts of Mexico, a considerable gain of gold may be anticipated. Ontario and the Yukon ought to do better in 1913; because the output of Porcupine will increase, for a time, at least, and in the Yukon the dredging operations of the Granville company will add to the territorial production. On the whole, we expect the world's output in 1913 to be about the same as 1912, the continued increase from the Rand being swallowed in the decline from Australasia, Mexico, and Russia.

WORLD'S PRODUCTION OF GOLD.

Estimated by the United States Geological Survey.

Year	Value £
1891	26,846,000
1901	53,630,000
1905	78,143,000
1908	90,810,000
1909	93,369,215
1910	93,484,028
1911	96,054,574

By way of comparison, we give the output for preceding years, indicating the rapid growth in production up to 1908. Since then the rate of increase has diminished. Indeed, it is doubtful if there has been any real addition to the gold available during the last five years, having regard to the hoarding of the metal in India. In that country the withdrawal of gold from circulation has averaged from £4,500,000 to £5,000,000 per annum. This is a fact at least as significant as the increased output of the Witwatersrand. Unless a new goldfield of first-class rank is discovered during the next decade, it is inevitable that the output of gold should decrease. But the decline will be slower than the growth.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

JOHANNESBURG.

Retrospect.—The year 1912 was, take it all round, a fairly prosperous one. The returns of the Chamber of Mines for the Transvaal show that the gold industry is still expanding. The comparative figures for 1911 and 1912 are as follows:—

	1911	1912
Tons milled	24,456,821	26,071,841
Stamps working.....	10,020	10,027
Stamp duty.....	7 76	8 29
Tube-mills.....	223	270
Output.....	£34,991,620	£38,757,560
Yield per ton.....	28s. 1d.	29s. 3d.
Working costs per ton	18s. 1d.	18s. 9d.
Working profit per ton	9s. 8d.	10s. 1d.
Total working profit....	£11,725,870	£13,101,016
Dividends.....	£8,066,437	£8,277,862

It is interesting to note the extending use of tube-mills; the ratio of tube-mills to stamps is now 1 to 37 as against 1 to 45. A disappointing feature is the drop in the proportion of working profit paid out in dividends. This has decreased from 69% to 63%, and the term 'working profit' has now become almost meaningless as an indication of what a mine is really doing. Underground no startling innovations have been introduced. Endless-rope haulage has proved a success in the incline-shaft of the Brakpan mine, and the belt-conveyor installation in the incline-shaft of the Apex mine is reported to have acquitted itself well during the short run it had. Small machines for stoping were more and more employed as a substitute for hand-drilling; and the driving of main haulage levels, the use of sand-filling and waste-packs instead of solid pillars for supporting the hanging wall, and the big-block system of development for flat-dipping mines, became generally recognized as useful practice. Increased attention was given to the prevention of accidents and to the amelioration of the phthisis evil. In metallurgy, the Butters slime-filter reached an established position, and the Nissen stamp and the zinc-dust precipitation press proved themselves worthy rivals to existing appliances. Tube-mills became persistent in the race for supremacy in ore comminution, but the sun of that thumping anachronism, the stamp-mill, has not yet set. In general, technically trained men were more in demand in all departments, and the disorganization and expense entailed by the ceaseless changing of the mine personnel began to force

itself on the attention of those in high authority. The coal industry showed a slight improvement, and the diamond industry a considerable one, while copper mining receded in importance, as also did tin mining, in spite of the notable encouragement given by advancing prices. The city of Johannesburg continued to grow in an astonishing fashion, and the dust-storms kept up with it.

City Deep.—This is a mine that has been asked to do man's work while yet a child; consequently, the result has been disappointing. Crushing started in December, 1910, with a plant designed for a monthly tonnage of 65,000, and in December, 1912, two years afterward, the monthly tonnage was only 39,400. The chief reason for the slow progress made in 'tuning-up' has been the shortage of native labour, coupled with the marked inefficiency of underground labour, both white and black. It is difficult to account for this inefficiency, as the physical constitution of the rock is normal, and the mine has been laid out on modern lines. The company at the end of 1911 had fully developed 1,442,902 stope-tons of an average value of 8'1 dwt., and development since that date has exposed ore of first-rate quality. From the point of view, therefore, of gold contents the prospects of the company are excellent. The large area containing 4,000,000 tons of ore lying between the present upper workings and the northern boundary is now being opened up from the cross-cut on the 2nd-level horizon, which intersected the lode at a point some 300 ft. below the boundary. It was intended to attack this ground by means of rises and back stopes from the upper levels, but the difficulties of ventilation and other drawbacks soon proved that this simple plan was impracticable. This rise-ground is favourably situated, and the value of the ore in it should be quite up to, if not better than, the average of the ore in the already developed portions of the mine. The company made a working profit of £284,134 during 1912, and paid a dividend of 12½% on its capital of £1,250,000. Everything indicates that this result will be much improved upon in the present year. In January, 1913, 42,700 tons were crushed, and the total working profit was £25,248. The working cost was 25s. 1d. per ton crushed, which must be considered high.

and the yield was 30s. 6d. The supply of native labour was considerably increased during January, but not early enough in the month to be effective. Greatly improved results are certain very soon. It is, perhaps, too much to expect the 1913 dividend to be double that of 1912, but it will certainly mark a considerable advance. When native labour is up to requirements and the efficiency of the underground force is up to the mark, this mine will become in fact, as it now is in prospect, one of the finest in the Union.

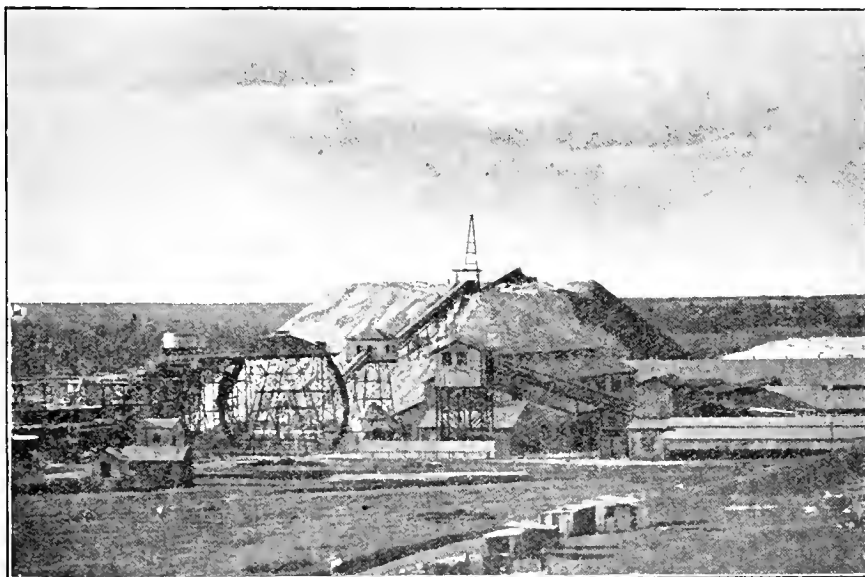
Modderfontein B gave an excellent account of itself during 1912. The plant throughout the year ran steadily at its full capacity, and the fact that the demand for ore was readily met went a long way toward proving the success of the underground arrangement. This arrangement is particularly interesting as it departs in many ways from accepted local practice. The workings have been modelled on those of a coal mine, with such modifications of colliery design as have been necessitated by the conditions of a gold mine. Development has been carried out on the big-block system, the levels being 1000 ft., and the winzes 800 ft. apart, the chief object being to open-up the maximum area with the minimum expenditure. Some secondary development has been done in order to facilitate the mining of these large blocks; but chiefly for the purpose of further prospecting them, it being recognized that samples taken round the periphery of such areas only approximately represent the average value of the lode contained within them. It is quite possible, indeed, that a block sufficiently developed for mining purposes and classed as profitable may contain a large patch of unprofitable ore, and conversely; and this would not be discovered if primary development only were relied upon, until stoping operations had opened-up the interior. Such a happening in a mine drawing its ore from a few long faces might cause violent fluctuations in the value of the ore milled and serious embarrassment to the management. It is a much debated point if the big-block system is desirable, many holding the view that blocks about 500 ft. square are as large as can be conveniently handled, and certainly as large as can be accurately valued for ore-reserve purposes. The conditions of lode deposition in this mine are favourable to the scheme, there being only one lode, averaging about 12 in. thick, and dipping at the moderate incline of 14°. This dip permits of branch tracks being led off the winze-tracks to the stope-faces at convenient intervals for the easy removal of the broken

ore. The loaded trucks are lowered down the winze-tracks by means of air-winchies to collecting stations on the main-haulage way, which has been driven nearly straight in the shade foot-wall under the lode. This haulage-way is 15 ft. wide, and is equipped with mam-and-tail haulage to near the main shaft, a short length of endless-rope haulage completing the distance. All the ore is hoisted through one central main 5-compartment shaft, 700 ft. deep. The underground performance of this mine is being watched with considerable interest in view of the possible adoption of similar development schemes by other Far East Rand mines now being opened-up. The average value of the ore crushed during 1911 was considerably higher than the average value of the ore reserve, as the policy of opening-up the richest blocks first was considered to be preferable to that of opening-up all the stopes in the mine prior to milling, when such work is usually costly. The profitable ore reserve at the end of 1911 was £2,355,700 stope-tons of an average value of 7.5 dwt., and the average yield obtained from this during 1912 was 36s. 2d., which is a higher yield than the exigencies of mining would appear to call for. The probable explanation of such a surprisingly good average yield is that the ore-reserve estimate was a conservative one and that the interiors of the blocks furnished ore exceeding the expectations based on the sampling of their peripheries. Shareholders are to be congratulated. The working cost during 1912 ranged from 19s. 2d. to 15s. 11d., the profit per ton from 14s. 5d. to 21s. 3d., and the monthly working profit from £21,500 to £35,985. Recent returns point to a monthly working profit of about £30,000, on which basis the dividend for 1913 should be about 35%. At any rate, the dividend for 1913 may be confidently expected to show a considerable advance on the 20% dividend of 1912.

New Kleinfontein.—This company closed its year with a reduced dividend, a considerable debt, and a life three years shorter than the one previously estimated. The reduction in dividend has been continuous during the last few years. In 1910 the company paid 22½%, in 1911, 17½%, and in 1912, 12½%. Toward the beginning of 1912 the plant was increased by 4 tube-mills and additions to the cyanide plant, in order to raise the milling capacity from 38,000 to 50,000 tons per month, and a large amount of advance development was done in preparation for the larger tonnage required from the mine. A loan was effected to cover this expenditure, which it was designed

should be repaid by the proceeds of a share-issue. Unfortunately the prevailing market depression rendered such a course impracticable, and a lower yield per ton and an increased cost, due largely to extensive faulting in the best area of the mine, left the company no alternative but to reduce the dividend. This reduction enabled the £85,000 capital expenditure for the year to be paid out of profit, thus avoiding an increase in the debt, which is estimated to amount to £205,000. In this estimate such assets as sundry debtors, stores, &c., representing some £50,000, are not considered. The official life of the mine has been shortened

appreciation from 7s. 8d. to 9s. 7d., and the total quarterly working profit has risen from £44,426 to £72,008. The yield kept steady at about 28s. throughout the year, and that this might have been higher is indicated by the fact that the ore reserve, which was 1,146,531 mill tons of an average value of 7.50 dwt. at the end of 1911, was 1,186,923 mill tons of an average value of 7.68 dwt. at the end of 1912. From this improvement in the reserve it may be inferred that selective mining has not been employed as a means of relief, and it would seem that the company is perhaps a little too cautious in its policy in this respect, in view



NEW KLEINFONTEIN.

from 18 years, as at the beginning of 1911, to 13 years, as at the beginning of 1913, consequent upon a fresh review of the position. The estimation of the life of a mine involves the weighing of much past evidence in its bearing on the future, and the many factors that enter into the calculation are only approximately measurable as regards their incidence upon what is ahead. For this reason any such estimate, however carefully made, must be looked upon as a fair diagnosis rather than as an accurate determination. The outlook for 1913 holds out promise of considerable betterment in the company's affairs. The working cost per ton has shown a steady reduction from 20s. in the March quarter to 17s. 10d. in the month of December, the profit per ton an

of the desirability of liquidating the debt as speedily as possible. The annual reports of this company are interesting documents, for, in addition to the full information they furnish to shareholders, they nearly always contain data of value to the technical man, and the forthcoming one promises to be specially instructive, as the consulting engineer will deal fully with the question of the life of the mine. Some historic interest attaches to this property. It had its mill burnt by the Boers during the war, and it was the pioneer of the mine-railway branch line and the belt-conveyor, and, finally, one of the last to succumb to the seductions of the tube mill. The illustration shows the belt-conveyor system as employed for dumping the tailing, waste rock, and ashes, which

is a mixture that responds less readily to the attentions of wind than the usual unadulterated tailing.

The South African School of Mines and Technology has shown commendable good sense in securing George Stuart Corstorphine, B.Sc., Ph.D., for its Principal. This post, as well as that of mining lecturer, fell vacant owing to the resignation of Professor G. R. Thompson, who combined both duties. Of late years the School has experienced great difficulty in finding suitable men to occupy the chair of mining, and changes have been frequent. Good lecturers in chemistry, mathematics, etc., are not uncommon, but a good lecturer in mining is rare in any country. The position is one calling for wide practical experience as well as accurate theoretical knowledge, and such a combination is seldom found in any man. The brilliant theorist will not spend years amid darkness, dirt, and danger in view of a possible professorship, and the sound practical engineer rarely possesses the requisite theoretical knowledge or the ability to deliver a lucid and interesting lecture. As regards Johannesburg, the lecturer's difficulties are aggravated by the attitude of the students, who are mostly up-to-date, lively, young South Africans, imbued with a by-no-means diffident regard for the all-conquering qualities of the Springbok. To restrain the natural *joie de vivre* of such healthy citizens, without endangering their regard, is not the least arduous of the lecturer's tasks. The new Principal is best known to the public as joint author with F. H. Hatch of the standard text-book 'The Geology of South Africa.' He has held the following appointments: Lecturer on geology, Heriot-Watt College, Edinburgh; professor of geology and mineralogy, South African College, Cape Town; geologist to the geological commission, Cape Colony; director of the Geological Survey, Cape Colony; member of the council of the University of the Cape of Good Hope; and consulting geologist to the Consolidated Gold Fields of South Africa. The Doctor's scientific attainments, administrative experience, and genial personality render the selection singularly fortunate.

Diamond-Cutting Industry.—The question of the feasibility of transferring the diamond-cutting industry from Europe to South Africa has been vigorously discussed in the local Press of late, with the result that the Union Government has appointed a select committee to investigate the matter. The subject was studied in Europe by the secretary to the Mines Department, H. Warington Smyth,

some years ago, and his finding was that the idea was impracticable. This view has, however, never been accepted by the people of the Union, who quite rightly cannot see why they should not employ their own people in finishing their own product. South Africa supplies the world with nine-tenths of its raw diamonds, and out of the total amount of diamonds annually exported the total wages bill of both black and white is only £3,000,000, and the industry employs only 4000 whites, whereas the overseas diamond-cutting industry gives employment to 20,000 whites, with a wages bill of £4,000,000. As 150 millions worth of diamonds has already been exported, and the cream of the profit has gone to speculators in Europe, who keep Derby winners and smoke half-crown cigars, the present state of things is exciting as much awakening surprise in the minds of South Africans as would the suggestion of the sending of all crude oil to Europe to be refined, excite in the minds of the Standard Oil magnates. In this matter any steps that the Government takes to foster the industry in the Union will have the whole-hearted support of the public, and it also will have the sympathy of all overseas thinking people, for the spectacle of a young country allowing itself to be exploited to suit the convenience and bank balances of a few Europeans who do not care a fig for it, must appeal to any person not dead of soul.

Conciliation Board.—The report of the Board appointed under the 'Transvaal Industrial Disputes' Prevention Act to investigate certain differences of opinion between the miners and their employers has now been published. As foreshadowed in my note of December, the whole matter proved to be a storm in a teacup, and nothing of a revolutionary nature was evolved by either of the parties to the dispute. After certain alterations had been suggested and approved in the wording of the miners' agreement form, in order to prevent the misinterpretation of any of its clauses, the debate appears to have centred round the problem of the basis of payment. The majority report maintains that the flat contract system is fair and equitable; the minority report insists that it is not, and considers a guaranteed wage essential, the amount of such wage to be 20s. per shift for those in charge of hammer-boys, and 25s. for those running machines. There is no doubt that the flat contract system is a bad one, and there is equally no doubt that the enforcement of a guaranteed wage of the amount suggested would favour the incompetent unduly, and so raise mining

costs above what they ought to be. It would seem that the matter is one for amicable arrangement between employers and employed rather than one for legislative enactment, and no doubt some agreement will be reached without setting in motion the cumbersome machinery of Parliament.

SAN FRANCISCO.

Alaskan matters do not receive the same attention from the politicians and the public that they did last year. The general election is past and congressmen who weathered the storm have all too little disposition to rush into the fray. The present session of Congress has been barren of results so far as Alaska is con-

several lines that are not operated and at Nome last season dog-trains pulled cars on the deserted tracks as the companies owning the road were not able to pay the operating tax of \$100 per mile. The Commission estimates that on a privately owned road rates would necessarily be above the maximum at which traffic will flow freely, and the facts seem to justify this view. It becomes, therefore, a question whether the development of the country is worth the price of the roads. The modest programme of the Commission calls for only a little more than 700 miles of track and an expenditure of \$35,000,000. This is not a large sum measured against the expected benefits. Deep-rooted opposition to Govern-



ALONGSIDE A DITCH ON THE SEWARD PENINSULA, ALASKA.

cerned and as the special session that the new President will call will be devoted to a specific programme, it is not likely that any radical change will be made for another year. The Alaska Railroad Commission has presented an able report and recommends the building of a line from Chitina to Fairbanks, with a branch to the Bering River coalfields. A second line from Seward to Iditarod, with a branch to the Matanuska coalfield, is also proposed. Both lines will have to be built at Government expense, as there is now no sufficient incentive for private capital to go into the business. Indeed, W. E. Clark, the Governor of Alaska, says that it is unlikely that any existing line is earning enough to pay interest charges and recommends that all taxation of railroads in Alaska be temporarily suspended. There are

ment ownership of railroads is a more serious obstacle than the size of the appropriation. In the meantime some progress has been made. The law relating to placer claims has been changed so that henceforth no 'association' placer claims in excess of 40 acres may be located in Alaska, and until patent shall issue not less than \$100 worth of labour shall be performed or improvements made during each year. A change in the provision regarding powers of attorney restricts the number of such powers to two for any one person in any one month. These changes will tend toward a fairer distribution of claims in new districts. The Governor, in his annual report, recommends that the excellent provision of the Yukon law be adopted in Alaska, permitting claim-holders to pay in cash to the road fund \$100

per year per claim, in lieu of doing assessment work. It is an open secret that much of the latter is of no benefit, while it often costs more to outfit an expedition and send it to the claims than is expended on the latter when the workmen finally arrive. In all such cases it would be economical to spend the money on the roads rather than the claims, and in the end everyone would benefit. It is hoped that this change in the law may be made.

Dividends continue to flow from the oil fields. In January \$679,140 was disbursed by the listed companies operating in California. The Union Oil Co., as usual, is at the head of the list, making a payment of \$184,753. Since the California oilfields were opened a few years ago, a total of nearly \$50,000,000 has been paid in dividends. Of this \$31,000,000 has been distributed by 13 companies, each of which has paid more than \$1,000,000; nearly \$7,000,000 by 11 other companies, each of which has paid more than \$500,000; and \$3,000,000 by 9 companies, distributing between a quarter and a half million dollars each. While profit from the oil business is only imperfectly measured by the dividends paid by these companies, this in itself constitutes a satisfactory and striking record. At present matters are running smoothly and nothing disturbs the even course of events. The Lakeview Oil Co. has drilled a second well near its famous gusher, and it is producing 3000 bbl. per day. There is still the possibility of a great gusher upsetting the market, but the fact that no such well has been found in two years breeds a feeling of security. There is much territory still to drill, but economy in production is attracting more attention. The restless ones who are satisfied only with the spectacular are turning to other fields. Litigation over titles continues to be a disturbing element and various suits to determine the relative rights of the Government, the Southern Pacific, and private claimants, are dragging their slow course through the courts. They do not, however, greatly interfere with production and to the Western country at large the last is the most important feature. A determined effort is being made to bring the pipe-lines under control of either the State or the National Government by having them declared common carriers. Pipe-lines are far and away the cheapest and most efficient means of moving oil, and in the oil business, as in many others, control of transport is the most effective means of controlling the industry. At present the pipe-lines are privately owned and convey only the oil belonging to their respec-

tive owners. An independent producer can sell, therefore, in large measure, only to the pipe-line companies. The result is that the transporting and refining companies, which are usually closely allied, fix the immediate price of oil in the fields. As always, the producer thinks that the middle-man exacts too heavy a toll, and here he is turning to the Government for relief. The same matter has been fought out in the Eastern fields and where the pipe-lines have been made common carriers no marked benefits have been apparent. The oil industry is by its nature one that requires regulation, but what form it should take is less certain.

Competition in lead smelting due to the entry of the International Smelting & Refining Co. into the field has begun to produce results. In the Coeur d'Alene, where the American Smelting & Refining Co. long had a monopoly, the Hecla mine has a contract with the new concern at \$16 per ton as against the old rate of \$22. Ready calculators in that district estimate that a like reduction to all companies would mean an increase of \$2,250,000 in local profits. Naturally, this has produced unrest. The most important producing company in the district is the Federal. This concern is listed as a Guggenheim property and is controlled through ownership of the common stock. Dividends on the latter have been discontinued since 1909 and minority holders are now protesting that the mining company is managed in the interest of the smelting company rather than for the benefit of its own stockholders. In particular, the smelting contract, made in 1905, is alleged to be unfair and, acting for the minor stockholders, Sidney Norman has brought suit for its annulment. At the time the present 21-year contract was made the Guggenheims controlled both the mining and the smelting companies and in effect made a bargain with themselves. Since then stock in the mining company has changed hands, but just how extensively is not known. The contract of which complaint is made does not include the customary provision for periodical revision and is admittedly more burdensome on the mine than later contracts made by the Guggenheims with neighbouring concerns. According to Mr. Norman's figures, assuming that last year's production and prices represent the average for the life of the contract, the A. S. & R. Co. will at its expiration have received \$32,547,312 from the Federal company, of which \$12,600,000 will have been excess charges, as judged by the contract made with the Hecla mine. To this Edgar Newhouse

responds on the part of the Guggenheims that the contract when made was considered a fair one by all parties in interest and that the real difficulties of the Federal company have arisen from the change in the character of the ore in the Morning mine. The latter is admitted to have been a serious matter, but one that the engineers of the company have happily met by improvements in milling. It will be remembered that it is at the Morning mine that the McQuisten tubes are being used so satisfactorily. Development of the matter will be waited with interest, as the case seems to be another where good work by the engineers brings but minimum benefits to stockholders because financiers refuse to consider themselves as trustees for all their stockholders.

CAMBORNE.

Grenville United Mines.—For the half-year ended December 31 last, a net profit of £18,662 was earned, and the dividend and bonus declared brought the total dividends for the year up to 40%, a most satisfactory result. The quantity of tin concentrate sold was 368½ tons, so that on the tonnage milled of 22,066, the recovery was about 38 lb. per ton. The manager, Henry Battens, states that the "average value" of the stuff was 39'23 lb., but with a recovery of 38 lb. it is obvious that the average assay-value of the ore was higher, and that his words mean something different from what they convey. The black tin sold realized £51,660 or an average price of £140, which is £13 higher than for the previous half-year, and speaks well for the quality of the Grenville product. The development amounted to 1735 ft., or one foot for every 12 tons milled, and this compares with 1 in 27 for the six months ended June 30 last. It is evidently the intention of the management to continue this commendable policy of vigorous development, for a new 10-drill compressor has recently been purchased and is now being installed. There can be no doubt that this is the right thing to do; formerly it was customary to stop an end directly it reached a barren zone, but in a mine like Grenville, with the ore occurring in shoots, such a policy would inevitably lead to disaster. The work of equipping Fortescue's shaft to the 375-fm. level is practically complete, and a drift west has been started, which should intersect the first ore-shoot at a distance of 27 fm. In the level above (the 355) the ore was of good quality in the floor, and high hopes are therefore held that a useful block of average stopping ground, 70 fm. long by 20 fm. high, will

be available when the drift is completed. It is proposed to sink Goold's shaft and to explore a large section of ground standing to the west.

The total receipts for the half-year figure at 49s. 4d. per ton of ore milled, the cost at 32s. 5d., and the profit at 16s. 11d. The latter is probably the highest margin per ton of any mine now working in Cornwall. With such handsome dividends, it is astonishing that the 10s. shares stand at only a premium of 5s. in the market. Perhaps this is due to the fear that if the mine is to be sunk much deeper, a new and more powerful pumping-plant will be required. At present, all three engines are running seven strokes per minute, and at this speed the quantity of water raised to surface in 24 hours is about 2¼ million gallons.

South Crofty.—The report of this company for 1912 has not been received with quite so much satisfaction as the one for the previous year, because, although the net profit earned is more than equal to half the authorized capital of the company, the frank statement issued by Josiah Paull, the manager, respecting the development of the mine during the twelve months is, on the whole, disappointing. The net profit was £25,201, or £6780 less than 1911, and the following comparison will clearly show the reason for this decrease :

	1911	1912
Ore milled	63,882 tons	66,076 tons
Black tin recovered.....	678 tons	628 tons
.. per ton milled....	23 76 lb	21 28 lb.
.. value	£76,586	£82,482
.. average price. ...	£112	£130
.. per ton milled....	23s. 11'73d	24s. 11'58d.
Wolfram recovered.....	149 tons	130 tons
.. per ton milled....	5 22 lb.	4 42 lb.
.. value	£147'17	£111 48
.. average price. ...	£100	£86
.. per ton milled....	4s. 7 29d.	3s. 4 49d.
Arsenic recovered.....	1009 tons	628 tons
.. per ton milled....	35'36 lb.	33'45 lb.
.. value	£9518	£9887
.. average price....	£9'5	£9'62
.. per ton milled....	2s 11'75d.	2s. 11'91d.
Development	4944 ft.	4685 ft.
Total cost per ton.....	21s. 6d	23s. 9d

It will be noted that the higher prices realized for two of the products were sufficient to offset the depreciation of the ore content, except for about 3d. per ton milled; in fact, when interest and sundries are added, the total receipts per ton milled are higher than last year. The fall in the profit is due to the increase in the cost, which is up 2s. 4d. per ton. This is doubtless largely explained by the advance in the prices of materials and the increase in wages, for the reduction in the development footage probably did not affect the total sum

spent, because a greater proportion this year was for shaft-sinking.

Except at one or two points, only low-grade ore was developed during the year. In Crofty, the new lode intersected in the north cross-cut west of Robinson's shaft at the 245-fm. level has averaged 70 lb. tin and wolfram per ton for an average width of $4\frac{1}{2}$ feet over the whole 111 ft. driven. The progress here has been hindered by lack of proper ventilation, but this will shortly be remedied by communication being made with the 225-fm. level. The new vertical shaft has now reached a depth of 730 ft. from surface, and it is expected that a further 300 ft. of sinking will intersect the North Tincroft lode at or near its junction with Pryce's lode. The junction of these two lodes in East Pool and North Tincroft made large bodies of ore, and there is no reason to anticipate that it will not in this mine also. The work should be completed this year, and will be watched closely by all concerned, for it is an important feature.

The detailed development report, which accompanies the manager's statement, and in which the values are given in pounds per ton of ore over the width of the drift, etc., is far in advance of the information usually supplied by our leading mines. In fact, South Crofty is excellently handled in most respects, and therefore it is surprising that the accounts are issued in such a form as to make it impossible to get at departmental costs. The management might in this respect, with advantage, follow the example of Carn Brea & Tincroft.

Dolcoath.—This company has had a prosperous half-year, the net profit, after allowing for depreciation, being £41,136. The receipts were 39s. 1d. per ton of ore, the working cost 25s. 6d. (including royalties and depreciation), and the profit 13s. 7d. The company's figures of working cost and profit always exclude such items as depreciation, extra remuneration of directors, etc., which, however, are just as much a working cost as the materials used. No operating costs are given, although in a mine of the size of Dolcoath, such must presumably be kept. It is quite true, as R. Arthur Thomas put it to the shareholders, that too much importance is sometimes paid to an increase in the working cost, whereas the main consideration should be the net profit, but this should in no way prevent the shareholders from having the costs presented to them in an intelligible form. In fact the best way to get a maximum profit is for a manager to have the departmental costs before him in detail month by month, so that he can put his finger

on any weak spot. The bottom of the mine has proved, so far, disappointing, for although occasional patches of rich ore have been found, the lode on the whole has been poor. While continuing to develop this ground, the results so far, coupled with the high price of tin, have led the management to turn attention to the exploration of lodes other than the main ones, which run through the property. Now is the time to undertake this work, and it is satisfactory to note that a start has been made with a cross-cut at the 210-fm. level north of the new Sump shaft, which will intersect these lodes below the old workings, so far as is shown by the plans. The ratio of development footage was only 1 foot for every 27 tons milled for the past six months, so that a more vigorous policy in this direction is justified.

Carn Brea & Tincroft.—The report and accounts for the half-year ended December 31, are referred to elsewhere in this issue.

As usual, Mr. King's address to the shareholders gives much food for thought. One of the principal matters to which he referred was the heavy mining cost in Cornwall. He made the statement that assuming each man earned 25s. per week, this works out on his costs at less than one ton of ground broken per shift. From his experience in Western Australia he put the average there as four tons per shift, so there is much lee-way to make up. It will not be made up, however, until the miner is convinced that his contract will not be cut if he makes good wages as a result of hard work. The Cornish miner in his prime is unequalled, but the proportion of such men working in Cornwall is small, the majority being old men and boys. The problem is to make conditions sufficiently attractive to keep the younger men at home.

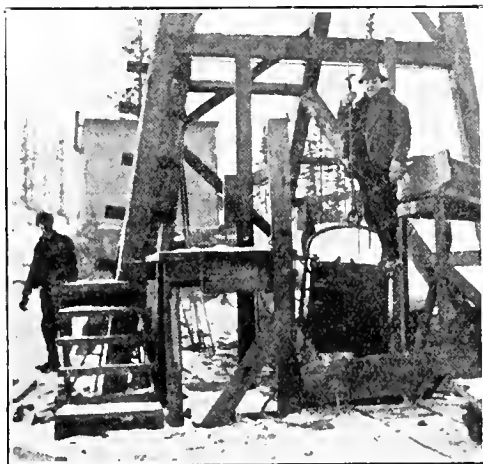
TORONTO.

Porcupine.—The Pearl Lake has succeeded in picking up on the 600-ft. level the big vein, which at 400 ft. had a width of 23 ft. with gold content averaging \$30 to the ton. It is of equal width and content on the lower level. A 20-stamp mill will be installed, the machinery for which is now en route. The shaft is being sunk to 800 ft., and the intention is to extract ore from all three levels as soon as the mill is ready. The 5-stamp mill of the McEnaney started operations on February 10. In consequence of a rich find on the fourth level, where the vein averages 6 ft. containing ore assaying \$48 per ton, and the encouraging results of development on the

200-ft. level, where the vein has been opened up for 550 ft. with ore carrying over \$30 per ton, it has been decided to increase the number of stamps to 20, and build an annexe for cyanide treatment. The main vein will be diamond-drilled to a depth of 1000 ft. At the Dome Lake, the vein has been definitely located on the 180-ft. level, where it carries 30 in. of ore averaging \$32 to the ton. The mill-building is in readiness for the installation of a 10-stamp mill. The capitalization of the company has been reduced from \$2,500,000 to \$500,000. The McIntyre mill has been started, and is expected to be in full operation by about the middle of March. The Swastika area has latterly excited much interest, on account of the shipments of high-grade gold ore from the mines near Kirkland lake. Smelter returns for a carload of 19 tons sent from the Tough claims show a product of 448 oz. gold and 465 oz. silver, of the value respectively of \$10,453, and about \$300. Another shipment of 30 tons stated to average \$600 per ton is being prepared. The bottom of the open-cut from which this ore was taken shows about one foot of high-grade ore. The Hughes property has also dispatched about 50 tons of high-grade ore, stated to average about \$400 to the ton. A 5-stamp mill has been ordered for the Tough property, and preparations are being made for sinking a new shaft. The Swastika mill is expected to be running in March. Only 5 stamps are being installed at present, to be followed later by a similar battery if the results of development warrant. The same plan will be followed by the Lucky Cross, where the building is in readiness for the installation of the first 5 stamps. The treatment adopted will be amalgamation and concentration. A. Charlton has purchased from J. Lavallie and E. Chaput their claim near Kirkland lake. Alex. Coburn and Wm. Morrissey have bought the McLaren claim near the Lucky Cross, on which two good quartz veins have been uncovered.

Cobalt.—The largest shipment of bullion in the history of the district was made on February 11, consisting of 163 silver bars containing 308,997 oz., of which 214,206 oz. came from the Nipissing mine. At this property, on the Meyer vein a stope between 15 and 20 ft. of milling ore is being opened. Shaft 64 has reached the depth of 550 ft. The Temiskaming has made a strike of high-ore in the diabase at the 575-ft. level. At the Chambers-Ferland, recently acquired by the Cobalt Aladdin, an English company, an important find has been made near the contact between the Keewatin

and the conglomerate. The vein is about 4 in. wide, and is stated to be rich in silver. The Aladdin company has also found high-grade ore at the lowest level of the old Silver Queen, which was supposed to have been exhausted. The Drummond has installed a new 30 h.p. electric motor for hoisting purposes, and is developing a large deposit of milling ore on the 125-ft. level. At the annual meeting of the City of Cobalt on February 5, the mine manager's report showed that there was approximately 1,269,662 oz. in sight above the 400-ft. level. The production for the year amounted to 234,802 oz. The directors were authorized to borrow sufficient funds to build a 100-ton mill. The royalty payable to the Province



PROSPECTING AT PORCUPINE.
George Furish on the bucket.

has been reduced from 25% to 5% on the net profits. The Buffalo has declared the regular quarterly dividend of 5%, in addition to extra dividends, amounting to 18%. With the payment of these dividends the mine will have returned to the shareholders a total amount of \$2,107,000, or more than twice its capitalization. Work was resumed this month on a number of properties on which operations had been discontinued for some time, including the Wright claim, now known as the Salvador, the Prince, the Silver Cliff, which has been purchased by R. C. Wignmore, of Toronto, the Alexandra now owned by the Ontario Gold & Silver Co., and the Belmont. The annual report of the Seneca Superior shows that the output since the early part of October was valued at nearly \$200,000, of which the net profits amounted to \$121,618, out of which a dividend of 10% was paid, leaving a surplus of \$73,980.

MEXICO.

The following paragraphs are taken from the diary of a distinguished mining engineer resident in the city of Mexico at the time of the most recent revolution.—EDITOR.]

Financial View.—One is tempted to speculate as to how this situation will affect investors in Europe, and whether it will be regarded there more favourably if Madero should overcome his opponent or should be overcome by him. On first view it seems to me that the general opinion would favour the winning of Madero, because he is at the head of what is probably regarded as the settled constitutional Government, and it is to the benefit of peace and order for revolutionary movements to be stifled. A broader view of the case might, however, take into consideration the fact that Madero is himself the wrecker of a constitutional Government and epoch, which maintained peace for 30 years, advanced the country to a position of first-class credit, and generally created the modern Mexico. Since the movement commenced by Madero to oust Porfirio Diaz was put into being, the country has been not only in an unsettled state, not only has lost enormously in prestige and in credit, but has actually reverted back to times which were considered barbarous in the extreme, since it coincided with bandit atrocities such as civilized communities have left far behind. Madero found the country with a full treasury and a great financial surplus. It ranked high in the list of stable powers, and its loans found a ready market in the world's financial centres. Madero, in two short years, has reduced the country to the level of Honduras, has wasted the nation's savings and reserves, has blasted its credit, and put its securities on a low level. The question may be asked: Will Diaz do any better? Has he the gifts to uplift the country to the position it has lost? Can he stamp out brigandage and lawlessness, and establish peace and order? These are difficult questions to answer. Diaz, at least, would not commit the gross error of imputing to the unlettered Indian an aptitude for democracy. He would recognize that the vast majority of his countrymen must pass through the processes of slow development before they can realize the responsibilities attending citizenship, as it is understood elsewhere, and that in the meantime the country must be ruled by a few men strong for right, and able to wield the power which they must take to themselves for the country's good.

Looking back over the whole position, the

most extraordinary thing to me is the chapter of events which has led up to the existing situation. The leader of the revolution, Felix Diaz, is the same man who led a revolt some few months ago, and captured the city of Vera Cruz, counting on the support of his fellow officers in the army to second his uprising. It is stated that Madero bought the loyalty of the officers by huge sums of money, and when Diaz went out to meet what he thought were his allies in Vera Cruz, they arrested him, and he was thrown into the dungeon at Vera Cruz, from which it was thought he would only emerge to be shot. A court martial was held, at which Diaz was condemned to be shot, and it was thought that no delay would ensue in carrying out the death penalty, as it was the general opinion, notwithstanding Diaz had the sympathy of nearly all the country, that for its own sake the Government should not stay execution for a moment longer than necessary. Delays, however, ensued, and it was suspected by the Government that efforts would be made to rescue Diaz from his Vera Cruz prison, and in order that he might be kept under the immediate eye of the central authorities, he was brought secretly to Mexico City and placed in solitary confinement in the military prison. His presence in the City, together with that of General Reyes, another revolutionary leader who failed, apparently gave rise to the idea that another movement against the Madero government might be carried through successfully. The basis of this new movement was that on February 16 certain soldiers who were supporters of Diaz were simultaneously to take Madero prisoner at his official residence in Chapultepec castle, seize the National Palace, which is the emblem of governmental power, and release Diaz and Reyes from the military prison. The plans of the revolutionists were betrayed to Madero, and it was decided to precipitate the plot. Accordingly, in the early morning hours of February 9, the students of the military college situated in the suburb of Tlalpam, and the entire garrison of the suburb of Tacubaya, in which is situated the Chapultepec castle, moved out from their barracks and marched to the City. After some preliminary visits to certain police-stations, where arms were secured, the students went to the military prison, and, surrounding it, demanded the release of the two generals, Diaz and Reyes. At first the Governor demurred, but was induced by the show of force to deliver the prisoners. Making a junction with the Tacubaya garrison, they attacked the National

Palace. Reyes was killed in this attack on the National Palace, but Diaz with his men easily captured the national arsenal, or citadel, with its immense stores of everything needful to wage and maintain modern warfare.

But how does all this reflect upon Madero and his administration? Surely a more fatuous policy was never followed than is here exhibited. Knowing that a plot was on foot, knowing the desperate character of the men at the bottom of it, knowing the leanings of the army as a whole to Diaz, they evidently took no precautions at all to safeguard their own positions. An entire garrison was permitted to march past the walls of the Castle in which Madero resided without any question being raised. The National Arsenal, with its stores and its impregnable position, was hardly guarded at all. Madero, the father of revolution, resting in fancied security, has been hoisted on his own petard. Laxity, maladministration, chaos throughout the country have marked his regime. His supposed ideals, of which no practical evidence has been given, either are too visionary for real life, or, what is much more likely, in the light of circumstances are vapid shadows, mere professions of a faith which goes only so far as to achieve the objects of his extreme personal vanity and ambition.

The question now arises: What has the future in store? Can the many factions in the army and in political life be welded together in one harmonious whole, or will the scramble for power and place begin all over again among those who feel aggrieved that they have not gained enough? In short, has the Diaz revolt accomplished any lasting good for the country, assuming, of course, that we have seen the end of the present fighting? Taking history as a precedent, what the people of this country need more than anything else at this moment is a strong hand. The flimsy ideals of the demagogue, who prates of the aptitude of the Mexican nation for democracy, must be put into the limbo of the forgotten. Power, represented by military discipline, strong to punish the guilty, stern to maintain order, inflexible in the pursuit of offenders against the general welfare: that is what the Mexican people understands, that is what they respect, and will willingly submit to. If Diaz has ousted an impracticable and pharasaical idealist and will substitute such elements as the country can furnish, which will institute something of the spirit of the old Porfirio Diaz regime into a new Government, then it seems to me he will have deserved well of his

country. Firmness—first, last, and always—must be the keynote in dealing with Mexicans.

The general feeling among foreigners and Mexicans alike is one of great exhilaration. It is agreed, on all sides, that the Government which is taking things over is as strong as Mexico can produce. It is essentially a military government, and that is what the country needs. The Madero regime has



After the Battle.

brought about anarchy, and it is only with guns that order can be restored, and I feel confident, for the first time in two years, that there is a good chance of seeing all bandits run to earth in the course of the next three months, and all communications opened again for safe travel. Diaz does not appear in the provisional Government, but he has kept out of it so that he may stand for President at the next election, and no doubt he will be elected.

PERSONAL

G. PIRCY ASHMORE is proceeding shortly to Venezuela, by way of New York.

GEORGE B. ATKINSON has returned from the Atbasar mines, in Siberia.

C. A. BANKS is paying a short visit to Edinburgh.

HUBERT P. BARRY and R. E. WILLIAMS have resigned their positions with the Waihi Gold Mining Company.

H. BERTRAM BATEMAN is not renewing his engagement with Pellew-Harvey & Co.

J. MACKINTOSH BELL sailed for Canada on February 26.

SEPTIMUS W. BELL has returned from the Ashanti Goldfields, where he was assistant metallurgist.

H. C. BELLINGER, of the Great Cobar, has arrived in London.

THOMAS BREAKELL has gone to Trans-Baikal, and expects to return by way of the Caucasus.

CHARLES B. BRODIGAN sailed for South Africa on March 1.

GELASIO CAETANI is at Rome.

WILLIAM A. CARLYLE has resigned the professorship of metallurgy in the Royal School of Mines, to take effect in June, when he will return to consulting practice in London, entering into partnership with JOHN F. ALLAN.

G. S. CORSTORPHINE has been appointed principal of the South African School of Mines in succession to G. R. Thompson.

J. C. W. CRAWFORD sailed for New York, on his way to Peru, on March 1.

ARTHUR DICKINSON returned from South Africa on March 10.

J. V. N. DORR has been to Panama.

THOMAS A. DOWN is manager for the Anglo-Portuguese Tin Co., at Belmonte, Portugal.

W. J. N. DUMACHIE has resigned his position on the Rand, and will be in London early in April.

NUTCOMBE EVERED has gone to Cobalt.

W. R. FELDMANN sailed for Ashanti on March 12.

DONALD F. FOSTER is returning from Prestea in August.

F. LYNWOOD GARRISON has gone to the Cauca district, in Colombia.

ANDRE P. GRIFFITHS is at present in Algeria and proceeds to Mexico on his return.

THEODORE HADDON, manager of the Globe & Phoenix, is home from Rhodesia.

G. A. HARRISON has returned from Russia.

C. S. HERZIG'S next lecture on 'Mine Sampling' at the Sir John Cass Technical Institute, Aldgate, E.C., will be on March 20.

A. W. HOOKE is going to Nigeria as manager for the Forum River Company.

L. H. L. HUDDART has returned from Nigeria.

ALFRED JAMES is at Cannes, recuperating after influenza.

J. T. KEATING will return from Nigeria in April.

NEWTON B. KNOX has returned from Peru.

J. V. LAKE has left England for Leon, Nicaragua.

S. H. LORAM has returned to Valparaiso.

C. H. MACNUTT has returned to London.

H. D. MARTIN is in the Baikal region of Siberia.

W. A. MERCER and G. A. RICHARD have been inspecting the Mount Oxide copper property in Queensland.

W. PELLEW-HARVEY is examining copper mines in Asturias, Spain.

R. A. F. PENROSE passed through London on his way to the continent.

EDGAR RICKARD is expected early in April, on his return from San Francisco and New York.

R. RECKNAGEL is expected from West Africa in April.

E. C. SAINT-SMITH has been appointed assistant geologist on the Queensland Government Survey.

W. J. SHEPHARD, manager of the South Bukuru, has returned to Nigeria.

W. EVAN SIMPSON will shortly return to Mexico.

EDWARD SKEWES is manager at Treburland, Cornwall.

L. C. STUCKEY has returned from Tarquah, West Africa.

G. W. THOMSON has left London for the Pahang Consolidated mines, in the Federated Malay States.

W. E. THORNE has gone to the Bodaibo district of Siberia.

SCOTT TURNER has gone to Tromsø, Norway.

E. J. WAY has resigned as consulting engineer to the Anglo-French Exploration Co., and will engage in private practice.

A. R. WEIGALL leaves on March 16 for Korea.

THOMAS WEIR is on his way to the Perseverance mine of the Alaska Gold Mines Co., near Juneau.

WALTER WETHERED and B. H. NICOLSON sailed on March 12th for Nigeria.

DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

The Radium Hunters.

The Editor :

Sir—After reading the serious and damaging charges you make against my professional reputation in the February issue of your magazine, I realized more than an answer in the Press was necessary. So I at once applied to the council of the Institution of Mining and Metallurgy to appoint a committee of investigation. I also intend subjecting your charges to a full investigation in the law courts, when you will have the opportunity of proving if your charges were justified on all the facts of the case, and I will have the opportunity of clearing myself in public. I would ask your readers to kindly suspend their judgment pending the results of these two independent investigations. What I cannot understand is why you ventured on what you must have known was more than a fair criticism without taking the trouble to ascertain the facts, because if you had done so I feel sure the charges would have never been made.

SYDNEY FAWNS.

London, February 24.

[The Institution has declined to take any steps in the matter while litigation is pending.—EDITOR].

Worthies.

The Editor :

Sir—In your editorial under the head of 'Worthies,' you left out what I consider a very important name and one that had a great influence in mining all over the world. I have never seen his picture and it may be impossible to get it, but nevertheless, Bartolomé de Medina (1557), the inventor of the Patio process, should have a place in your list.

At Pachuca, Mexico, they have a fine building erected in his honour, the Teatre Bartolomé de Medina. His work in Mexico has been imitated in all quarters of the world and it is only in the last few years that the Patio process has had to give way to newer and better methods.

Those that are familiar with Mexico never cease to wonder at the wonderful exploration and development work done locally by the mining men in the 16th and 17th centuries. The good Father Bartolomé was responsible for a great deal of this and, if I am not mistaken, his work was responsible for the introduction of British capital into the country.

Looking back, I am sure that Father Bartolomé was a real mining man and directed as well as invented. There is a great deal in this when one comes to think over it. Humboldt was a traveller, but it must be remembered he was a noted one and had all kinds of assistance to see everything with the least possible trouble to himself. He may get into the list of 'worthies' and deserves it, but it is certain that the good Bartolomé had a more difficult row to hoe and carried it to a splendid finish.

ALEXANDER H. SMITH.

South Porcupine, February 2.

[The point is well taken. Bartholomé de Medina is undoubtedly one of the notable characters in the history of mining. He invented the Patio process in the Purisima Grande mill, at Pachuca, in 1557. Up to that time only the richest ore could be smelted, and there was no process for treating the low-grade product of the mines. He was the first to apply amalgamation to silver ore, although that chemical method had been long used in extracting gold. He also elaborated the method for treating silver sulphides by chloridizing with salt in the presence of copper sulphate, using the tread of mules to mix the charge. This is the Patio process, so called because it is performed in an inner court or yard (the *patio*). For 350 years it was the characteristic feature of Mexican metallurgy, giving place only recently to cyanidation in its most modern applications.—EDITOR].

'Ore.'

The Editor :

Sir—As regards the definition of 'ore,' there has been already a great divergence of opinion prevailing among mining engineers here. As any definition, I understand, it should be as brief, conclusive, and self-explain as possible. Especially for mining terms, any additional explanation more than necessary may mislead either at once or in the near future, for mining industry is every day progressing and changing.

So far as I can see from various suggestions in your paper, there is invariably one and the same attempt being made by all to explain it fully but for a definition which itself means definite explanation, I should say it is rather too fully to put in those variable and indefinite things such as 'profit,' 'quantity,' and 'richness.' These things are rather factors for us to choose ore deposits to satisfy ourselves, but by no means they are fixed elements for us to determine what ores are. Already Mr. Edward Walker has shown us how difficult to consider

what is so called 'profit' and he suggested not to bring 'profit' into the definition. I quite agree with him but unfortunately, he also brought out the idea of 'profit' unconsciously in his definition, through mentioning 'large enough quantity' and 'sufficient richness,' which, as I have said, only point whether the ore is profitable or not but do not point to us whether it is an ore.

Moreover, quantity and richness do compensate each other, as far as profit is concerned. It is not true for an ore necessarily to be in "large enough quantity" and at the same time has "sufficient richness." Thus how difficult it is to pack in all these variable and inter-dependent things in a definition to secure a correct sense. So I propose not to attempt to make any description of this sort at all for the further reasons as follows:

A large quantity is only a desirable thing to have but it is not necessary for one to call his extracted stuff an ore only when it is in large quantity. For instance, I heard from some of the engineers in Dolcoath, saying to me, "Oh, we raised some horn-silver ore at well from the north section some time ago; it was only in a patch, and weighed a few hundred tons." Well, a deposit of a few hundred tons is by no means a large quantity, but he has not yet been challenged by any one for calling his a few hundred tons horn-silver an 'ore.' Further, there is no standard as to show how much a deposit ought to be for so-called 'large enough quantity,' with which every one will be satisfied.

We shall face similar troubles and misunderstandings if we give a description of richness. Gold alone is worked from 6 dwts. or ever lower up to any desired richness. How and how much the richness can be considered sufficient is a question that nobody can answer. Further, those poor deposits not worthy to be extracted may be on a day considered rich enough for extraction in the near future with better plant and capital. Again, as the masses of the world are getting more enlightened, surely there will be a day that any extension of colonies is impossible: there exists every possibility that, simply for employment and benefit of the society, some good government will sacrifice certain things (such as 'profit' in the sense of money) to work up the low grades which would not be touched by capitalists who are too much concerned by their own private 'profit.' Here again, if that government is possible in the future, richness will be entirely out of question.

So, if we want to make a definition, for ore,

brief, conclusive, true, self-explain and once for all, we should not lay much stress on 'profit,' "quantity" and "richness."

Lastly, I think there is no need too for giving so little and incomplete information of geological occurrence of ore deposits on account of the following reason:

It is true that lodes do not occur at every corner of the earth but there may be deviation too from that statement. For instance, aluminum silicates are everywhere, in igneous rocks, clay or even mud, etc. It is only at the present time when the science of metallurgy is not perfect that they cannot be economically treated as ores of aluminium but quite possible in the near future, we will be able to make silicates as pretty nice ores of aluminium. Then, these ores will be everywhere and serve as instances contrary to Mr. Walker's statement that ore occurs "at any *particular* place."

For myself and for me to propose to Engineers here, I should use the following:

'Ores.' Metallic mineral or rock containing such mineral or minerals, occurring in quantities, more or less concentrated by nature and advantageous to mankind to be extracted.

It strikes my mind, as I am a Chinese, that to make a translation of definition of ore used in China may be interesting to you, although that definition has yet never been subjected to scientific discussions. It runs as follows in its own language:

金石未成器者謂之礦。

The following is its translation in English: "Mineral or rock or rock containing such mineral, before it is made use in the form of an article, etc., is called an ore."

In my definition, I have brought out natural concentration into the question; I think it will imply richness, etc., in a better sense.

P. BAO.

London, February 24.

[We have not revised this interesting letter, believing that the slight divagations from conventional English are in character.—EDITOR].

Nissen Stamps.

The Editor:

Sir—I would like to correct a statement made by Mr. Alfred James in his annual review of gold-silver metallurgy for 1912 which appeared in the January 5 issue of the *Mining and Scientific Press*, wherein he claims that

recognition of the Nissen stamp tests at the City Deep has not been made by the large mining houses of the Rand.

Although this criticism applies to some of the groups, Mr. James has apparently overlooked the fact that it was owing to the enterprise of the Central Mining & Investment Corporation that these tests were made, and that they were conducted by them and at their expense. In recognition of the results the Central Mining & Investment Corporation have since purchased only Nissen stamps, besides including them in the designs for the large New Modderfontein plant they are about to build. The adoption of these stamps by the Consolidated Gold Fields for their new mills now being built in Rhodesia is, I feel, also due to the results of these tests.

PETER N. NISSEN.

London, February 27.

[It is not customary to publish the correction of a statement appearing in a technical journal except in the journal in which it appeared, so we print Mr. Nissen's letter with an apology to our friend the editor of the *Mining and Scientific Press*, on whose kindly indulgence we count.—EDITOR].

Capital Amortization.

The Editor :

Sir—I am obliged to Mr. Morton Webber for his reply, published in your issue of February, to my remarks on his article entitled 'Debentures in Mining.'

The inception of Mr. Webber's method of capital amortization is due, as he says, to the unreasonableness of the income-tax laws of England, in treating 'destructive' and 'constructive' enterprises alike. He expresses the opinion that funds set aside (out of profits) for capital redemption would not themselves be taxable by the Inland Revenue authorities, but only the accrued interest thereon. This I believe is an erroneous assumption, and that Mr. Webber's method would fail in securing exemption from taxation, as income-tax in England is levied upon the profits of a company regardless of their destination; that is, whether they be distributed to the shareholders, utilized in the creation of a reserve fund, or be otherwise applied. Furthermore, not only would income-tax be charged on the interest accruing from time to time on such reserve fund, but assuming this interest to be re-invested, the income derived therefrom would, in its turn, be subjected to tax in like manner, and so on *ad infinitum*.

As regards the steadying and raising of the

market quotation of mining stocks, which is the advantage claimed by Mr. Webber, it is no doubt true that a share in a company possessing a large reserve of cash or ore would have a higher and more stable market-value than it had during the period of accumulation of such reserves, but at the same time this advantage would be largely discounted by the fact that these reserves would themselves be mainly dependent on the fortune of the mine, and thus liable to be diminished or swept away at any time. It is, therefore, still my opinion that the majority of original shareholders in a mining company, after seeing that due provision had been made for keeping ore-reserves reasonably ahead of requirements, would rather have full dividends distributed which they could re-invest or otherwise deal with on their own account than be forced to contribute to a sinking fund subject to mining risks.

If Mr. Webber aims at the return of an investor's capital, I prefer an issue of bonds or priority shares entitled to all the profits of the company until 100% has been paid thereon, and ranking thereafter *pari passu* with the vendor and promoter's shares.

A. G. WHITE.

London, March 3.

Taxes in Mexico.

The Editor :

Sir—In your issue of November 1912, you state that an important Federal ruling in Mexico is to the effect that mining taxes paid to the revolutionists during their control of Chihuahua need not be paid a second time to the Federal authorities.

I do not know the source of your information in this connection, but what I do know is that I, for myself, and for certain important interests which I represent in Mexico, had to make a double payment of taxes under the very circumstances you mention. The mining taxes to which I refer were paid when due, in the Federal office at Chihuahua, at the time when the revolutionists were in control of the State, and later, when the next payment became due, the Federal Government demanded and received from me, under protest, re-payment before the later payment then due would be accepted, and for these payments I hold receipts.

Any one acquainted with the working of the mining laws of Mexico, while recognizing the injustice of the demand, will understand why it would not have been advisable to refuse the re-payment demanded. It is indeed a matter of much concern to many foreigners and for-

eight companies owning mining property, railroads, and lands in Mexico that the present condition of the country does not permit of many properties being operated, or even protected in any way. There does not appear to be any prospect of any settlement or even betterment in the state of affairs. Revolutions will go on indefinitely and meantime mining taxes, etc., have got to be paid, under penalty of confiscation.

Usually it is a costly matter to open and again start a mine or plant which has been shut-down for any length of time. To have to shut-down entirely is in cases a very serious thing to some concerns, and in a mine where there is a heavy flow of water in the workings and continual pumping necessary, it even means in many instances the end of the enterprise. Certain mines within my knowledge never will be opened-up again, if ever the workings are allowed to get under water. A property abandoned under such circumstances usually causes a heavy loss to the owners, and is, at the same time, a loss to the Government and to the country.

It is absurd for anyone to endeavour to lessen or smooth over the conditions at present existing in Mexico. The country is in a most deplorable condition from one end of it to the other, and will continue in that condition until there arises some man capable of taking charge of affairs and who, while holding the confidence of the people and extending justice and equity to all, will at the same time rule with the strong iron hand necessary for the good of the country and the welfare of the people themselves. Till then, there will be neither peace nor security in Mexico, and every enlightened Mexican knows it, as well as every foreigner conversant with the country and the people.

The question that meantime concerns the foreign owners of mining, railroad, and other property interests in Mexico is, how long are such conditions going to be permitted to continue, and who is going to foot the bills for all the damages and depredations that have been and are every day being committed by the various armies of ruffians who overrun the country under the name of 'patriots' and 'revolutionists.' If the anarchic conditions existing at present throughout the Republic are allowed to continue much longer, then the ruin of Mexico morally and financially is not far distant. It is already pretty well advanced.

ADIOS.

Vancouver, B.C., February 1.

British Columbian Production.

The report giving preliminary estimates of the production of metals and minerals in British Columbia during 1912, was presented by W. Fleet Robertson, Provincial Mineralogist to the Bureau of Mines, on January 13. The following table gives the amounts and values:

ESTIMATED PRODUCTION, 1912.				
		Quantity.	Value.	Increase over 1911.
Gold, placer	oz		\$ 500,000	\$ 74,000
.. lode	..	10,000	1,960,800	235,287
Total gold			\$ 5,460,800	\$ 309,287
Silver	oz	7,000,000	1,670,000	717,907
Lead	lb.	8,000,000	1,520,000	450,479
Copper	..	1,000,000	8,338,500	3,766,856
Zinc	..	8,500,000	501,500	172,408
Total metalliferous			\$17,497,000	\$5,616,937
Coal	tons, 2,240 lb	2,650,000	9,275,000	1,599,283
Coke	..	261,000	1,584,000	1,187,970
Building materials, etc			1,250,000	702,738
Total value of production			\$32,606,000	\$9,106,938

It will be noted that in every case an increase is shown as compared with 1911. The increase in placer gold was \$74,000 and in lode gold \$235,287. Practically all the placer gold is obtained in the Cariboo district (\$230,000) and the Atlin division of the Cassiar district (\$250,000). The increase in lode gold has come chiefly from the Boundary district, in which is included the Osoyoos, Grand Forks, and Greenwood divisions. The Nelson division shows a slight increase, but Rossland a decrease. In the Boundary district a comparatively large proportion of the gold is obtained in copper smelting; the Granby and British Columbia Copper companies together produced 67,000 oz. gold. In the Rossland district, the Consolidated Mining and Smelting Co., operating the Centre Star, War Eagle, and Le Roi gold-copper mines, is the chief producer, and the next is the Le Roi No. 2. Of silver producers, the Slocan district leads. More than two-thirds of the silver obtained from British Columbian ores was recovered at the Trail smelter. As regards lead, the Sullivan mine in East Kootenay heads the list. The St. Eugene, once a leading producer, is now in the background. The mines in Boundary district are the foremost in the list of copper producers. Most of the zinc is obtained as concentrate as a secondary product in lead and silver mills. The Standard, Van Roi, and the Monarch are the chief producers.

THE RIVER SIL AND ITS GOLD

A gold-gravel district, in Northwestern Spain, worked by the Romans, and now receiving attention once more.

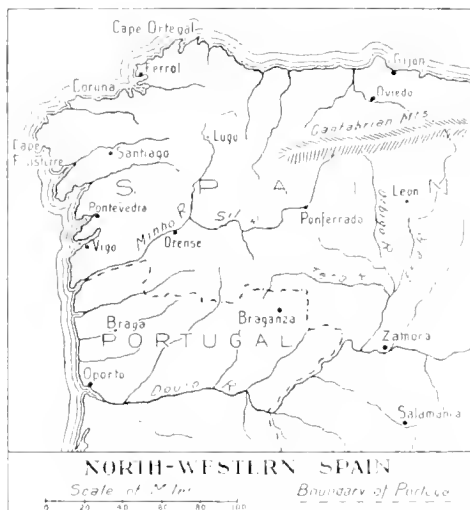
By JAMES HOWLISON.

MUCH has been recorded by ancient and modern writers concerning the alluvial deposits in the northwestern part of Spain. Nevertheless, up to the present little has been done to test them, and some of those who have undertaken serious work have chosen ground that would have been considered neither valuable nor fit for dredging had proper geological and dredging experience been brought into play.

Ancient writers mention that the Romans recovered gold, but throw no light on the yield of the gravel nor the expense connected with its recovery, and present-day writers can give us no further information. They assert that the Romans worked and recovered much gold, but, like the ancients, they are vague about the contents of the alluvial deposits. Still, as we know that the Romans sent great quantities of gold from this district to Italy, it is only natural to assume that the ground they worked must have been rich and that they would pay little attention to poor ground. They worked to the water's edge of the river Sil all along its confined parts, from Toral to its junction with the Minho, but knew no method of working the river itself, except at Montefurado, where, by tunnelling, they diverted it, and laid bare a mile of its bed.

It was thought that the gold left in this Roman tunnel must be enormous, and a company was formed in London to work it as well as the dry river-bed, which had been laid bare. But it was quite a mistake to think that any gold would remain in this tunnel, even supposing that the gold moved down-stream, because when the river is in flood the tunnel acts as a great syphon through which stones, rocks, sand, and everything passes. Nothing could settle. This company was also led to believe that the Romans did not work the dry part of the river-bed. Any doubt on this score was set at rest, when the company completed another tunnel and a canal leading up to it on the lower side, to divert the water from the Roman tunnel for the purpose of securing the "tons" of gold understood to be lying there. This canal was about 18 ft. deep just before entering the tunnel and it made a complete

cross-section of the Roman's last 'paddock' or workings, which showed nothing but fine silt and sand. Now, the Romans would work from the lower end of the property, and the tailing from the first paddock would be thrown up on to the existing river-bed, but from the second and subsequent paddocks they would fall into the worked paddocks; consequently, the last paddock would be left as a great hole



to be filled by the river, when in flood, with sand and fine stuff in suspension, as all the rocks and stones would pass through the Roman tunnel, which was in the direct line of the river. This company, therefore, did the public a good turn, although it spent most of its capital in doing so.

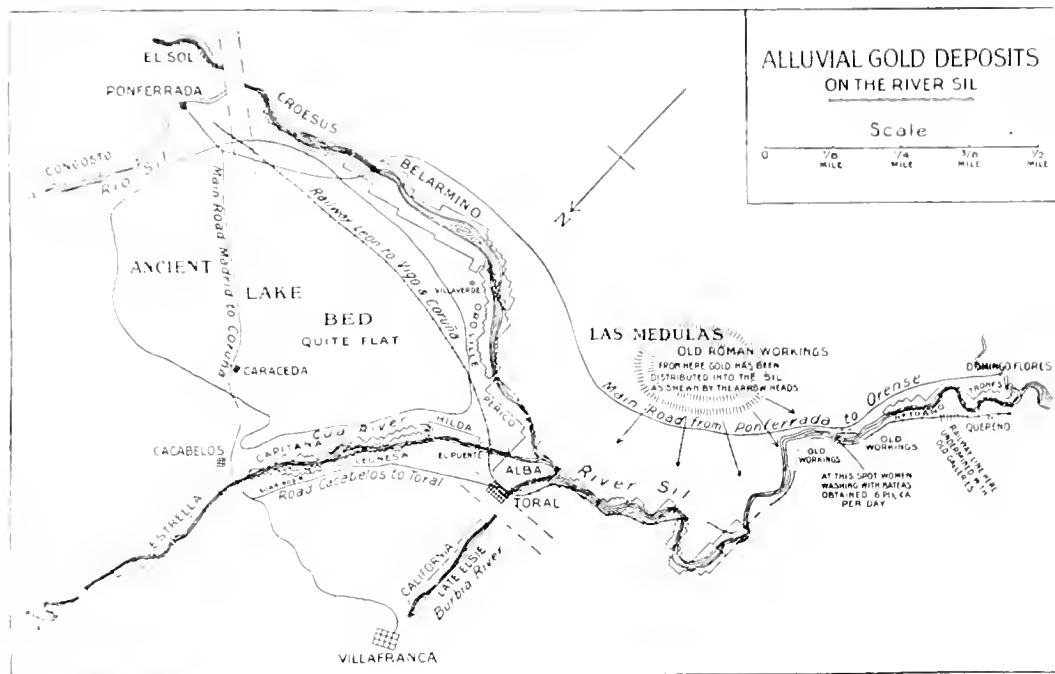
I have spent the greater part of the last three years examining this part of Spain, using a Keystone drill, a centrifugal gravel-pump, and a powerful bucket-dredge during the time. I have, therefore, had ample means of proving these statements.

The Sil rises in the province of Leon, and flows into the Minho, which empties itself into the Atlantic Ocean just at the northern boundary of Portugal and Spain. There are a many great deposits of gold-bearing conglomerate, and other alluvial almost as ancient. These

have been the main feeders of the Sil and some of its branches. Two of the most important deposits, both worked by the Romans, are Paradeseca, near the source of the Burba, and the Medulas, a little to the south side of the Sil, which have fed this river with gold from the township of Toral downward. They may not be rich enough to work today, when agricultural rights have to be considered, but it does not necessarily follow that rich gravel, if found today in the river, must have been shed from a rich source. Nature, in the erosion and disintegration of a poor deposit, has

and is too poor to be dredged profitably. But all this gravel has enriched the Sil, especially where its banks are confined enough to allow of concentration and deposition. The Medulas, before mentioned, have poured their gold contents into the Sil by means of every creek and gully from Toral to Quereno. These Medulas show enormous old workings by the Romans, who had not to contend with any vested land interests such as exist nowadays.

Every bend of the river between Toral and Orense, wherever gold-bearing gravel has been deposited, has been worked by the ancients,



allowed the river with its great sluicing power to carry away the detritus and leave the gold.

In my tests, with the Keystone drill, of the rivers that feed the Sil, I proved that one carried a channel fairly rich. This channel issued from a large deposit of conglomerate near its source, which had been worked by the Romans, but which I considered too poor to think of working at the present time.

This river is confined, and for about four kilometres offers a splendid chance for dredging, if satisfactory arrangements could be made for expropriation, which just now seems impossible. The other river runs into, and forms part of, the ancient lake extending from Ponferrada to Toral, but here the gold going into the lake has had too great a chance to spread,

and at one place near Quereno, when a deep cutting was being made at the time the railway was in course of construction, a number of old Roman galleries were uncovered. These had been driven from the river, the gravel being removed and washed. They had no means of working the river itself, but at Montefurado, where it forms a horseshoe bend, they drove the tunnel, previously mentioned, through a ridge—a distance of only 113 metres—and diverted the river, leaving about a mile of its bed dry, which they then worked by hydraulic methods. The only reason they had for thinking there was gold in the river was the fact that they had found gold on either side of it at various points, and from this they evidently thought it worth while

to go to the enormous trouble of tunnelling.

The deposits are of glacial origin, like those in the alluvial districts of Otago, New Zealand. Many are aware, though it may not be generally known, that the Molyneux river, in New Zealand, has proved itself to be a great dividend-payer, though the average yield from its gravel was only 8d. per cubic yard. There were a few cases in which 5s., 6s., or 7s. was obtained, but the greater bulk of the dredges got the lower yield. The Molyneux is only about 150 miles long, but it carries an enormous body of water, traverses an alluvial gold

patch of rock is encountered. These rocks can easily be overcome by taking advantage of the river, when in flood, to pull the dredge over, thereby ensuring continuous work all the year round.

It has been said to me that nothing in the way of gold mining has paid in Spain. This might apply to auriferous quartz mining. It is a peculiar fact that in most cases where alluvial gold is found in paying quantity no auriferous quartz veins exist. Other people say that if such gold existed in Spain surely British engineers would have found it out long



THE RIVER SIL.

region and has, therefore, acted as the main sluice of the country; consequently the gold is there found in a concentrated form. The river Sil, in Spain, is of much the same length, and, except that it does not carry the same quantity of water, is identically a proposition similar to the Molyneux.

Although from the township of Toral, almost to the sea, the Sil carries gold, it is not to be thought for a moment that it contains gold all the way or can all be worked by dredging. The river runs through granite, schist, and limestone country: a great part of it is crossed by hard intrusive rocks quite impossible to dredge and often bare of gravel; in very few cases, however, does the gold disappear into the banks, so that when once rich ground is struck there will be no getting off it until a

ago. But it must be remembered that gold dredging has been developed in New Zealand, Australia, and the United States, and is a branch of mining little understood or quite neglected by the British mining engineer, so that this argument has nothing to support it. There is the evidence of work by the Romans, and I have proved conclusively by my own work that payable gold exists.

The average width of the Sil is about 100 metres, but it is not to be taken for granted or assumed that the channel of gold-bearing gravel extends across its full width. I have proved it to be not more than half this distance. Transport to all parts of the Sil is good, as the Northern Railway follows the river for its whole length, and the main road is also generally available.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Feb. 1913	Jan. 1913	Feb. 1912
£65. 12s. 5d.	£71. 18s. 6d.	£63. 0s. 5d.

The market has again gone through a period of acute depression, and standard copper was at one time sold as low as £63. The renewal of active hostilities in the Balkans, the general tension of political feeling in Europe, and the increase of the Mexican disturbances have all assisted in developing the feeling of extreme distrust that has afflicted this market no less than the bourses of the world. Impressed by the heavy fall in standard, the electrolytic refineries have at last made a radical cut in prices and open competition is re-established. From 16½ cents they have sold down to 14¾ cents, and have succeeded in marketing large amounts both at home and in Europe. Dealers have consequently been emboldened to take lines of refined copper, which in the depleted state of consumers' supplies they will be able to dispose of readily. For March shipment a large trade has been effected, but some of the largest buyers have still to cover for that month. With the change in sentiment on the part of consumers, bears, who had been exceedingly active, have been covering, and it is probable that there still remains a large account to be bought back. Should the political horizon clear, as the best informed advisers anticipate, the business suspended by the outbreak of hostilities should gradually revive, with a quickening of demand for copper. Warehouse deliveries in England are good. The demand for sulphate seems to have revived slightly, although there has been no large increase of business so far.

TIN.

Average prices of cash standard tin :

Feb. 1913	Jan. 1913	Feb. 1912
£220. 6s. 3d.	£228. 5s. 0d.	£195. 4s. 10d.

A reactionary tendency from the high prices of January has been observable through the month, and it culminated in almost panicky conditions toward the end. Bears, led by the unsatisfactory condition of the South Wales tinplate industry to attack the market, succeeded in bringing prices down to £206. 10s. for three months. A good deal of buying then ensued, which drove prices up once more to £213, at which level the month closed. The position remains uncertain. American buying

has been active even for forward delivery, orders extending over many months having been placed. English ingot tin has been scarce, smelters being unable to satisfy the demand for early delivery.

LEAD.

Average prices of soft foreign lead :

Feb. 1913	Jan. 1913	Feb. 1912
£16. 8s. 5d.	£17. 1s. 11d.	£15. 13s. 9d.

Prices here have also been reactionary. Consumers' purchases have mostly been confined to spot delivery, while supplies during the whole month have been deficient. As a consequence a heavy premium has ruled for spot metal, while the forward demand has been slow. In March, much of the supplies that have been delayed by bad weather are due, and their arrival will probably alter this position, while at the same time a further lowering in quotations is probable. The consumption is good and likely to improve. The Mexican disturbances are curtailing supplies from that country.

SPELTER.

Average prices of good ordinary spelter :

Feb. 1913	Jan. 1913	Feb. 1912
£25. 4s. 3d.	£25. 19s. 1d.	£26. 6s. 5d.

As anticipated in our last number, the syndicate has cut the prices, but the response from consumers has been disappointing. Outside sellers have made concessions, and by doing so have only strengthened buyers in their resolve to wait. A further lowering of syndicate prices must be expected. It was deferred at the last meeting. There must be a great deal of spelter for April delivery still to be placed.

OTHER METALS AND MINERALS.

Prices quoted on March 10 :

SILVER.—27d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £90 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£35 to £36 per ton.

QUICKSILVER.—£7. 15s. per flask.

MANGANESE ORE.—10d. to 1s. per unit.

IRON ORE.—Cumberland hematite 27s. per ton at mine. Spanish 22s. delivered in England.

PIG IRON.—Cleveland 63s. per ton. Hematite 83s. per ton.

WOLFRAM ORE.—33s. per unit (1%).

THE SEWARD PENINSULA, ALASKA

The exploration of gravel deposits in the North. The use of the hydraulic elevator. Dredging. Working frozen ground.

By C. W. PURINGTON.

INTRODUCTORY.—Since the first discovery, in September 1898, at Nome, the product of gold from the Seward Peninsula has been subject to many fluctuations and may be now said to have fallen to a minimum (approximately \$3,000,000) from which a renewed increase may be expected. The accompanying figures exhibit the gradual decrease :

1906.....	\$7,500,000
1907.....	7,000,000
1908.....	5,120,000
1909.....	4,300,000
1910.....	3,500,000
1911.....	3,100,000
1912.....	3,000,000 (approximate)

The total production of the Seward Peninsula to date has been under \$65,000,000. As the product has in no year exceeded \$7,500,000 it cannot be said that the gold of Seward Peninsula represents an important contribution in the world's production. From a technical standpoint, however, the production of this gold and the methods by which it is obtained are of present interest and are likely to become of greater interest in the near future.

The increase in the production of alluvial gold from sub-Arctic regions has been discussed during the past two years in this magazine. This increase has occurred not only in Alaska, but in Siberia also, and is due to the better understanding of the conditions governing work in high latitudes. Fifty years ago, the white population "north of fifty-four" degrees in the western hemisphere consisted largely of fur-traders, lumber men, small farmers, and adventurers of a petty and rather futile character. Rapidly, however, since 1890, northern countries have been developed for gold mining, and among them the Seward Peninsula has occupied a prominent place. The romantic and too often sordid history of the early days at Nome has been frequently told and need not be repeated here. Much of the litigation which so hindered the mining industry has disappeared.

The structural geology and economic conditions of the Nome district have been so thoroughly discussed in the many able reports

of the U.S. Geological Survey and by T. M. Gibson, Charles Janin, and others, in the technical press, that I shall confine myself to a few of the salient features of the mining industry as observed during my visit to the Peninsula last summer.

Taking the strip of territory northward from Nome for a distance of 100 miles and for a width of 20 miles, the cream of the country



DOG TRANSPORT

may be said to be included. This strip includes all the tundra mining within the territory of the Anvil creek delta and neighbouring small streams whose drainage is superimposed on the tundra; it also includes the benches of Anvil creek and the dredging areas of Dry, Otter, Hastings, and neighbouring creeks; also the undoubtedly important dredging areas of the Kugarok river drainage.

magnitude is carried on without the use of the elevator. A hydraulic elevator consists first

A subordinate area lies about 100 miles to the northeast of Nome, along Ophir creek, where several rough equipments fully described in my report of 1905¹ were in operation. These have now been supplanted by small but efficient dredges. Outlying regions such as those along the Solomon river, Shovel creek, and near Candle, Fairhaven, and other Arctic camps, have considerable and growing importance, but the present paper will not consider them. The Cape York tin district merits special mention. The 2 $\frac{3}{4}$ foot sluice-box dredge operating on Buck creek produced 92 tons of black tin in 1911, and 175 tons in 1912, the concentrate running from 64 to 68% metallic tin.

TRANSPORT. It is unfortunate that the narrow gauge railway, about 90 miles long, connecting Lane's Landing, on the Kugarok river, with the town of Nome, has gone out of business. This road would be of considerable assistance in the transport of machinery for the dredge installations now contemplated. Almost none of the original rolling stock is in use on this railway, for, if any motor vehicles are used, the Government imposes a tax of \$100 per mile per annum on the company. The public uses it as a common highway, each individual making his own truck, to which dog-teams ('dogmobiles') are attached. During 1912 coal was hauled by horses on this railway to supply the steam-shovels at work on the Mocene ditch.

The dogs of Nome, celebrated as fast travellers when drawing sleighs in the winter, are no longer allowed to take their well-earned holiday. They work winter and summer. I made a journey of 100 miles on a small railway hand-car drawn by dogs, from Nome to Salmon lake and return. The dogs are allowed to rest on the car during the down-grade stretches, and the passengers, more or less covered with dogs, coast merrily for distances of from 2 to 12 miles where the slope permits.

In the early spring comes the annual dog-sleigh race, in which the whole population of the Seward Peninsula takes as much interest as does New York in a National League baseball game. In 1911 the winning team, owned and driven by Scotty Allan, and composed of Alaska dogs, made the distance from Nome to Candle and return, 360 miles, in 80 hours and 50 minutes, including all stops. The longest stop of 6 hours and 40 minutes was made at Candle, the northern terminus. Six teams

started, and four finished; the first and second prizes going to Alaska dogs, while the third team was composed of Siberian dogs. The owner of the winning team receives annually a batch of letters, mostly from England, making inquiry concerning the pedigree of the dogs. But, alas, the sleigh dog of Alaska that tried to trace his ancestry would probably have a harder time than even the common or Mayflower variety of plutocrat who starts out to link himself to William the Conqueror.

The old days of Nome, when the town had a population of from 8000 to 10,000, both winter and summer, are gone for ever. The population is now reduced to something like 5000 people in summer and 2000 in winter. This decrease shows that the methods of working the mines by hand-labour are rapidly on the decline and that work is not afforded to more than 20% of the former population.

Social conditions at this isolated Arctic camp are interesting. It is one of the few places in the civilized world where men can obtain a high wage and where living is not commensurately high. No one is employed at less than \$5 per day and on the 'creeks' board is given free. This board and lodging may be reckoned at from \$1.50 to \$2 per man. The season lasts only from June 25 to October 5 on an average, that is, about 100 days. The steamer fare, there and return, is \$150 from Seattle. A man's outfit, of which the principal item is rubber boots, will cost him about \$25; consequently a good labourer can net about \$300 per summer season. Several cases are known to me where men have gone up year after year working as day labourers and have saved a reasonable amount of money, which they invested in ranch land on the Pacific coast. Labour unions are represented, but they do not appear to make much progress. In general, the population is extremely efficient and intelligent, no drones or worthless characters being wanted. Incapable members of the community are soon weeded out and leave for the 'outside.'

One-man methods have practically passed away, and only a few operators are still working with sluice-boxes, horse scrapers and so forth. Practically all the derrick plants, small mechanical lifts, track and incline arrangements, and the like, have given place to hydraulic plants or dredges.

HYDRAULIC MINING is confined now to a very few places, notwithstanding the immense amount of money that has been spent in the past in the construction of water-conduits for this purpose. No hydraulic operation of any

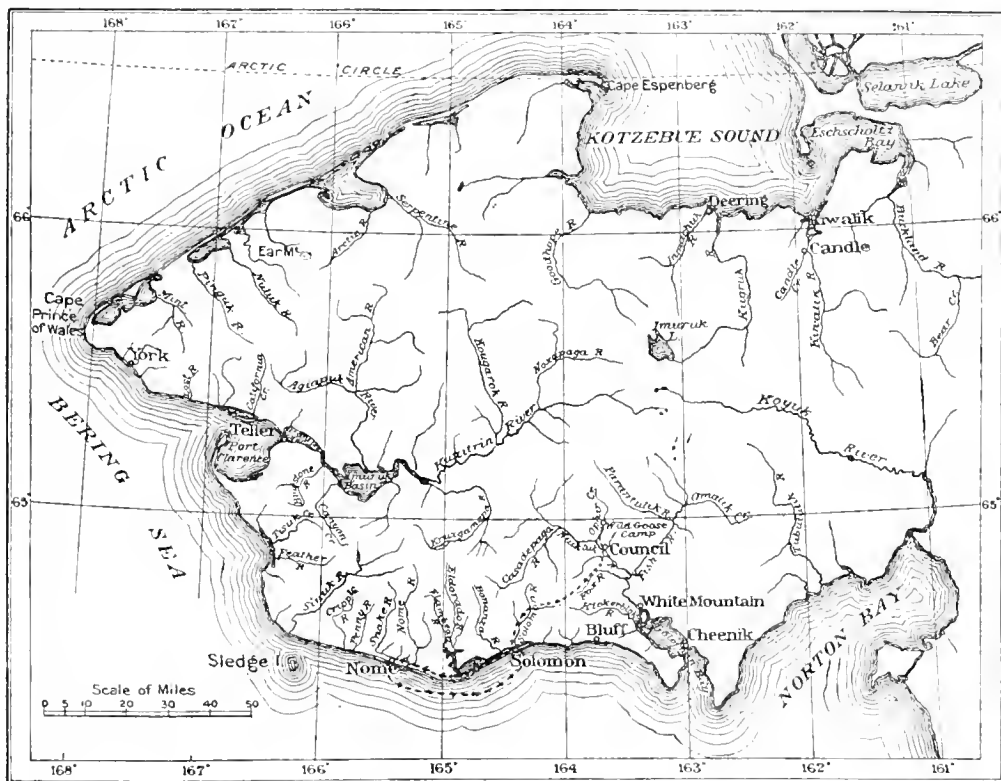
¹Bulletin No. 263, U. S. Geological Survey 1905. "Methods and Costs of Gravel and Placer Mining in Alaska."

of a heavy casting in the form of a cylinder, about 3 ft. long and 15 inches in diameter, choked to a throat, 12 in. or 13 in. in diameter and having an opening on one side near the bottom end, 10½ in. or 11 in. in diameter. In the bottom, which is closed, is fitted a nozzle ½ in. in diameter, which points upward. The lower end of the nozzle is screwed to a goose-neck casting, the outer end of which enlarges to 15 in. diameter and is bolted direct to the sup-

Mining Company on Little creek, four miles north of Nome and on the left limit of Anvil creek, just below the junction of Specimen gulch.

In the first of these places frozen gravel is hydraulicked, and in the second the gravel is almost entirely unfrozen.

The duty of the miner's inch, which is perhaps the most important factor in this class of mining, may be defined as follows: It con-



MAP OF THE SEWARD PENINSULA.

ply pipe which brings water under pressure from the penstock. The force of from 300 to 400 miner's inches of water under from 160 to 260 foot head creates a vacuum in the up-cast pipe, which is 16 inches in diameter and sets at an angle of about 30° from the vertical. This pipe is from 26 to 30 ft. long, the lower end being bolted to the upper end of the elevator casting. The gravel, being sucked in at the opening, is raised and shot through the upper end of the pipe against a manganese-steel hood, set over the upper end of the head-box of the tail-slucice.

The largest operations of this character are those under the management of the Pioneer

sists in the number of cubic yards of gravel per miner's inch of water moved from the bank, transported by water through steel sluice-boxes, set in bed-rock, to the throat of the elevator, and lifted to a vertical height of from 20 to 30 feet, to the tailing sluice, and properly stacked on the tailing pile, in the space of 24 hours.

The miner's inch is the standard of 1½ cubic feet per minute. This does not correspond to the 'inch' in general use by the larger ditch companies at Nome, which is 1½ cubic foot per minute.

At Little creek, where three or four elevator plants were in use during the past summer,

the duty of the miner's inch was 1'09 cubic yards. In the unfrozen gravel of the Anvil creek benches, on the operations known as No. 1 and No. 2 below Specimen gulch, the duty per miner's inch as determined by accurate survey and measurements under my direction was 2'63 cubic yards. It is interesting to note that in unfrozen gravel the duty of the piping giant alone (considered irrespective of the elevator and tailing-giant) is 12'38 cubic yards per miner's inch, and 4'42 in handling frozen gravel. In a word, it shows that by far the greater portion of the water is used by the elevator, which is probably the most inefficient method of lifting gravel. Three to four different nozzles are used in each operation, namely, either one or two for piping, one in the throat of the lift itself, and one for stacking the tailing at the end of the sluice.

Although the hydraulic lift has been in use in the Nome district for the past 10 years, and at the present time is in greater vogue than ever, it is at best only a makeshift, and fills the breach between the methods of handling gravel by hand, horse-scrappers, derricks and so forth, and the final operation now rapidly being instituted, that is, dredging.

In certain parts of Anvil creek and like areas, characterized by heavy serrated bed-rock and large boulders, the hydraulic elevator is perhaps the only system possible and the high tenour of the gravel makes it profitable. On the other hand, the so-called old beach and tundra areas, of which the tract between Nome and Little creek is representative, present a better condition for dredging than for the elevator now in use.

A great deal of money has been spent in building ditches that are partly or altogether useless. The amount of water wasted by the hydraulic lift was not taken into account by the parties who projected the original ditch-lines, nor was it realized of what subordinate use these ditches are for the generation of hydraulic power. It is safe to say that water ditches at Nome will gradually fall into disuse for the purposes intended when they were built. They will be used for generating power to some extent, though even this use will be regulated by the cheapness and the greater convenience of oil-fuel.

Oil from Coalinga, in California, can now be landed at Nome for \$1'50 per bbl. if taken in large quantities, and the same price would apply also at the more sheltered ports along the south coast of the peninsula. Any increase in this price during the next few years is not likely, and one naturally looks forward to the

time when the erection of a custom power-plant for the dredging industry will be warranted. The transmission of power, for example, from Golofnin bay to York, would involve a distance of less than 180 miles, and all other distances from Golofnin bay to the present dredging fields would be shorter. The best site for a power plant would depend on many conditions. Among these the vicinity of one of the large ditches, for the supplementary use of water, might be one. It has been found, however, that there is not much difference in the cost of power at Nome generated by water or generated by crude oil, using ordinary steam plants. With the use of steam turbines or large gas-producer engines, it is almost certain that the advantage in economy will be against the ditches.

The ditches are important in that the frozen silt that covers the tundra behind Nome, and which in the Kugarok region covers the benches, is easily ground-sluiced when water is allowed to cut channels through it, and still more easily disappears when subjected to water under pressure. The vegetal overburden, also known as 'muck,' often contains lenses of solid ice, perhaps several hundred feet long, known as 'glaciers.' The material averages from 50 to 75% in water content, and where a grade of $\frac{1}{2}$ % is available, a stream of water, coming from a $1\frac{1}{2}$ -inch nozzle under 200-ft. head, will melt the frozen 'muck' like butter.

A systematic removal of the 10 to 20 feet of this overburden should be undertaken in large areas, laying out so many acres for the season's work and distributing so many inches of water per day from the ditch for this purpose. The first operation is the ploughing of the mossy cover in the spring. If this is not broken to a depth of one foot, the water will not attack the frozen silt underneath. The breaking is best done by gang-harrows, drawn either by horses or a traction-engine. The 'caterpillar' used at Nome for this purpose does not seem as practical as a traction-engine or motor-truck fitted with 6-ft. tyres. Following the breaking of the sod by the above method, comes the hydraulicking of the 'muck,' which, for each nozzle used, can be done at the rate of from 20 to 40 acres to a depth of two yards per season of 100 days, according to the nature of the ground, amount of grade, etc. The cost of this operation will depend entirely on the scale on which it is conducted. In large operations it will be under 2 cents, and in small ones may cost 10 cents per cubic yard. The rain, sun, and atmospheric action



GIANT AT WORK: ELEVATOR ON THE RIGHT.



HYDRAULIC ELEVATOR BEING CLEANED JUST BEFORE DISMANTLING

will melt the remaining thickness of 'muck' to the top of the gravel, but will have little effect on the underlying gravel, which must be thawed by steam, so far as present experience at Nome indicates.

It has been lately brought forward in this magazine, and elsewhere in the technical press, that the removal of this frozen 'muck' in the Klondyke region is all that is necessary in order that the underlying gravel will thaw to bedrock. I am not prepared to say that in the Klondyke region this natural thawing is impossible. In the Nome district, on the other hand, it is certain that very little natural thawing of exposed gravel will occur. I place the depth to which the sun will thaw this gravel at a maximum of six feet, in the tundra area. Whether this be on account of the less grade or of the greater humidity of the climate, as compared with the Klondyke, is difficult to say. No experience in the Seward Peninsula up to the present justifies the assertion that exposed gravel over 6 feet in thickness will naturally thaw to bedrock.

DREDGING.—There are at present in the Seward Peninsula, and for the most part in the southern part of it, about 40 dredges at work or under construction. As the dredging season only lasts, at the most, for 150 days, the work is carried on during this short season with feverish activity, no stops being made either day or night, except for unavoidable repairs or for 'clean-ups.' In many cases there has been more enterprise than judgment exhibited in the erection of the dredges, several installations being on ground not previously prospected. Others are on plots of ground where the yardage available is insufficient to last more than two or three years. Hitherto nearly all the dredges have been installed with the idea of working comparatively narrow strips of unfrozen river-bed, lying between flat or sloping banks of frozen material. Even the most sanguine exponents of gold-dredging have not thought it wise to tackle frozen ground with the bucket-dredge.

But this form of dredging both in the Nome district and in the Kugarok, Candle, Goodhope, Fairhaven, Solomon, and other partly frozen areas, must necessarily be short-lived, for the unfrozen areas are quickly exhausted. Recourse must be had to some method of dealing with the frozen flats alongside the river-channels, which are greatly in areal excess, and are in some cases profitably gold-bearing. Where these areas are flat and shallow, steam-thawing in front of the dredges seems the most practical method.

Practically the only example of this process, where steam-points are used in front of a dredge, is afforded by the so-called Plein dredge operating at Otter creek, a small sea-beach tributary of the Nome river. Photographs of this dredge and portable thawing-plant are shown. The two boilers, totalling 80 h.p., are mounted on skids, covered with tents, and are moved forward as fast as required to keep ahead of the dredge. Forty points are in use thawing to 14 feet in depth. The duty of each point averages 16 cubic yards in 24 hours, and the cost is under 13 cents per yard. Were the overburden stripped by hydraulic means in advance, the cost even at this small plant would be less, and the duty of the steam higher. The cost of power generated, with oil costing 7.27 cents per gallon delivered at the plant, is 3 cents per horse-power-hour.

The total cost of dredging and thawing at this plant is stated to be 27 cents per cubic yard, handling about 800 yards per day. The cost at this plant, while extremely interesting, should not be considered as representative of what can be attained when operations are conducted on a large scale.

For the Nome tundra area, it is not going too far to say that under favourable conditions, where a sufficiently large yardage is available and a proper equipment installed, the entire cost of stripping, steam-thawing, and dredging will be under 20 cents per cubic yard.

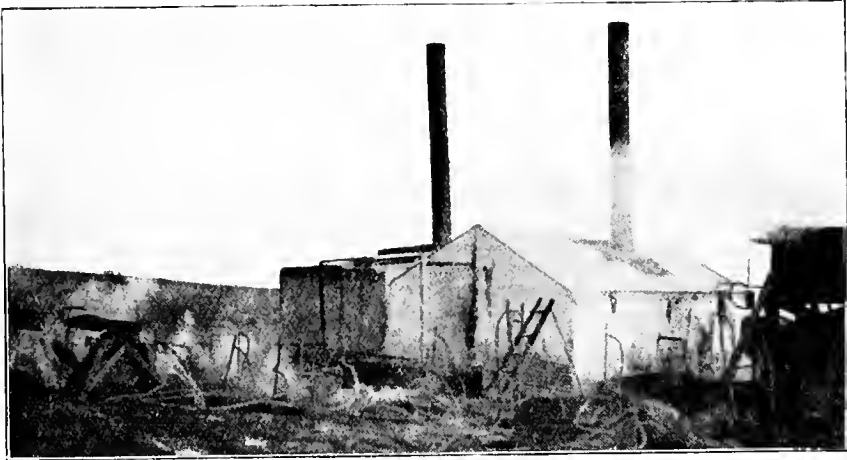
To come to a second possible dredging asset, the so-called Third beach and its vicinity has hitherto presented an insuperable problem to the miner. I refer, of course, to the six miles of the original bedrock pay-channel which have produced from a buried ribbon of gravel or broken bedrock, averaging 50 feet wide and 2½ feet thick, over \$12,000,000. The operations along this strip supplied the population of Nome with occupation and gold for five or six winters.

The famous winter dumps, on the Portland Bench, Bessie Claim, and others, which were washed after the water was liberated in the spring, were largely the product of the third beach strip. This asset has now disappeared.

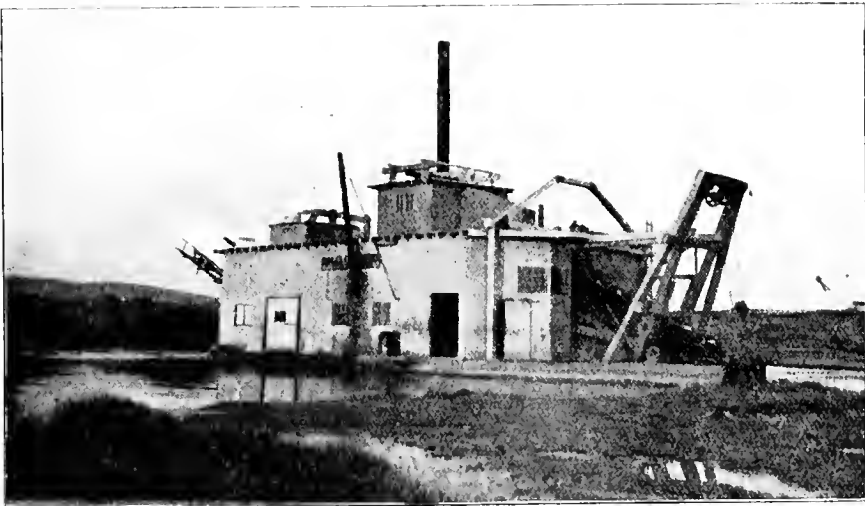
Drifting was possible only in those operations of the area where the gravel was solidly frozen. Many parts of the sea-beach, especially near the mouth of Dry creek, have hitherto defied every effort of the miner to win the gold on account of an excessive flow of water. Attempts at freezing the shafts have been, and are being, made to recover the gravel from these thawed areas. It is not

likely, however, that a sufficient amount of gold is recoverable from any one area to warrant the costly freezing of shafts. What, then, will be the solution?

The methods which bid fair to be successful on the deep frozen gravel at Nome, represent an entire novelty in American placer-mining practice. It is probably to a modification of



STEAM-POINTS AND MOVABLE BOILER-PLANT IN FRONT OF DREDGE.



DREDGE AT WORK

The conditions are as follows. The total depth varies from 80 to 120 ft., from the grass roots to rich pay. Some fine gold occurs throughout the entire section of fine gravel lying beneath the 'muck.'

the Australian pump-slucing barge that we shall owe a means of exploiting deep gravel in which permanent frost prevails. I have shown that the duty of an inch of water, when piping only is required, is unexpectedly high

when acting on frozen gravel. Three facts, first, that water under pressure will attack frozen gravel; second, that over 4 cubic yards of tundra-gravel in 24 hours can be thawed, broken down, and moved to a sluice or sump, by one miner's inch of water; and, thirdly, that at Nome oil-fuel can be made to generate power at a cost of between 1 and 1½ cents per horse-power-hour, give a basis for the method. In the Australian system, the piping is done in the pit, and the gravel and water raised from the sump by a centrifugal pump mounted on a barge that rests most of the time on bedrock. A temporary structure, carrying the tail-sluice, is erected on the bank of the pit, and into this sluice the pump discharges, sometimes at a height of 60 ft. above the intake. A pressure-pump, used for hydraulicking, is also mounted on the barge, the whole plant being steam-driven and self-contained. If the gravel is deep, 100 ft. or more, the work is done in two stages, and many plants in Australia working gravel over 100 ft. in depth have been successful.

At Nome, pressure-water is often available, eliminating the need for pumping. In order to move frozen gravel, the piping must be done not against the bank but from the top of the bank into the pit; this introduces a complication, which can doubtless be overcome. It may be that in shallower areas, say from 25 to 45 ft. deep, some form of barge equipped with bucket and stacker working in connection with nozzles that will break down and shove the gravel to a sump, will be successful. It may be able to compete in cost with the bucket-dredge preceded by steam-points. The failure of the bucket-line elevators used in the Klondyke was due in a large measure to their immobility.

Mr. H. G. Peake has recently drawn up a project for the handling of frozen gravel in Siberia under conditions which are not very much dissimilar to those at Nome. This plant resembles a dredge in almost every respect, with the exception that the hull is constructed with the idea of its resting on bedrock the greater portion of the time. Where uneven bedrock is encountered the inequality will be compensated for by the use of 4 spuds. The bucket-line which performs only the function of raising gravel from a sump, and does not dig into any fresh ground, will naturally be made of much less strength than on the ordinary dredge, and will be consequently less expensive to construct.

While it is not contended that plants similar to the above described have been as yet

used successfully in frozen gravel areas, it is highly probable that the frozen gravel problem will be successfully met within the next few years by plants similar to those which I have attempted to describe.

The Australian idea of mounting all the necessary machinery on a barge or hull sitting on bedrock for the period of the 'set-up,' and which can be moved at will by the simple expedient of flooding the pit, is a valuable one, and this idea properly applied can help miners in all countries where frozen gold-bearing gravel abounds.

The material along the third beach line and for a distance away from it of about ¼ mile, representing the so-called 'slough-over,' is very fine, consisting mostly of beach sand and pebbles not exceeding one inch in diameter. This material is much easier to hydraulick than the material now being handled near Little creek. Consequently the duty of the miner's inch may be considerably higher than I have indicated above.

It is considered that at three separate points, namely, where Dry creek, Cooper gulch, and Anvil creek break into the tundra, there are deep-lying areas of beach-gravel. Detailed drilling has been done in some instances, and the samples obtained render it probable that hydraulicking with an improved form of elevating will be feasible. Consequently this locality, taken in connection with the shallow and easily dredged area lying below and surrounding it, presents an important gold reserve. Beyond the vicinity of Nome the Seward Peninsula presents many possibilities for dredging. The layers of gravel in the Kugarok, Ophir creek, Candle, Fairhaven, and other districts, will not exceed on an average 15 ft. from surface to bedrock, and whether frozen or not, there is no insuperable obstacle to dredging. Ideas change with the progress of events, and I am frank to say that recent developments in the north have caused me to entirely alter my former opinion that frozen gravel could not be successfully handled by the gold-dredge.

One asset exists in the Seward Peninsula to which little attention has been paid. In several parts of the area, notably in Bangor and other creeks tributary to Snake river, considerable quantities of scheelite, the tungstate of lime, are found in the gravel. This concentrate is found in all the clean-ups of the placers. Considering the high commercial value of this mineral, some deposits of it might be found sufficiently profitable to exploit, especially when associated with gold.

MINING IN THE ARGENTINE REPUBLIC

By W. EVAN SIMPSON.

Spanish exploitation. Wild speculation. General Geology. Famatina district.

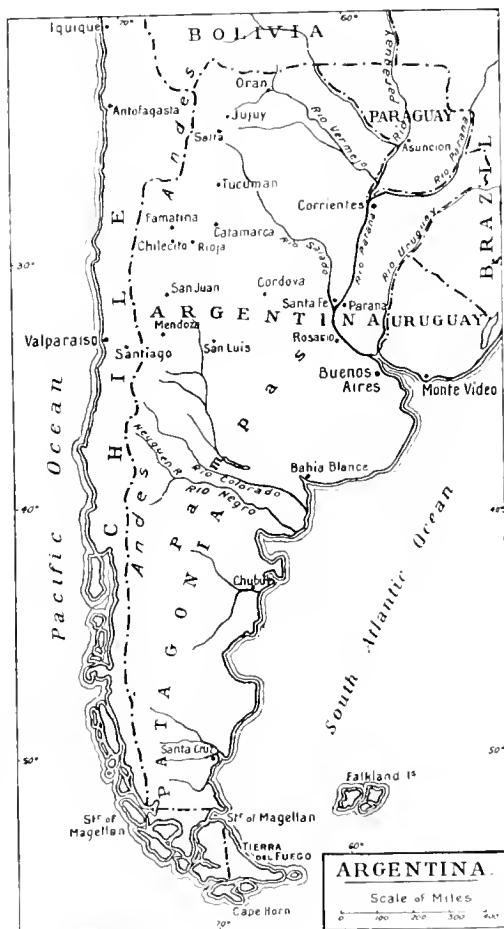
INTRODUCTORY.—The name 'Argentina' suggests association with silver mines, and that of the chief river of the country, Rio de la Plata, would appear to indicate that silver had at some time been discovered in large quantities in its channel. Investigation shows, however, that these names are derived not from anything connected with the production of the country itself, but simply from the fact that in the early days of Spanish rule the river was a highway for the transport to Europe of silver from the mines of Bolivia, Peru, and adjacent countries. The present Republic owes its name to the silver ornaments worn by its inhabitants at the time of the conquest and to having a position on the side of that river from which the silver was believed to have come.

Such early exploration as was undertaken in the country was the work of the Jesuits during the 18th century. When they were expelled, in 1767, practically all mining ceased until within the last 25 years, when operations were resumed in many localities by private individuals, and with some measure of success.

The existence of mineral deposits has now been fairly well proved for the entire extent of the mountainous part of the Argentine, which is some 2500 miles long, but although, within the last few years, large sums of money have been subscribed and many hundreds of companies promoted, ostensibly for mine development, comparatively little serious work has, so far, been attempted, and, consequently the value of the mines, where they do exist, is much discounted. In fact, to the Argentine resident, 'mining' appears rather as a legitimate means of plundering the public, and the 'mining engineer' is classed as a sort of confidence-trick man who can hypnotize his listeners with entrancing reports of limitless wealth in some inaccessible region, and get them to part with their cash while under the delusion that they are being enriched.

It must, however, be conceded that, in the past, the local speculating public have themselves been largely responsible for their own disasters, by the encouragement, always given, though often unconsciously, to the promotion of enterprises founded on the display of glittering or highly coloured specimens of mineral

wealth alleged to have come from some remote part of their own country. Naturally, samples of gold-bearing quartz prove the most seductive and the tales relating to it are almost in-



credible. For instance, the visitor cannot inquire into the history of mining in the Republic without being informed of what is now known as the San Juan del Oro swindle, an affair that occurred some four years ago, when three or four prospectors arrived in the city of Buenos Aires from the far north-west and exhibited broadcast some wonderfully fine speci-

mens of alluvial gold. These, they said, had been found near the Bolivian border, but, I understand, they were subsequently proved to have come from Australia. The sensation produced was intense, and if reports be correct, the display of these specimens in the show-window of a large emporium in one of the main streets, collected such a crowd as to seriously interfere with the pedestrian traffic. In the fever of excitement, some of the wealthiest business people of the city signified their willingness to purchase an interest in the property. This suggested the formation of a company, the shares in which were simply rushed by public applicants, the buying and selling being carried on with a recklessness akin to insanity.

Two dredges were ordered without any delay, and an expert was brought from New Zealand to supervise the practical operations. The publication of this information, during an energetic Press campaign, brought the market-value of the property, I understand, to a total of nearly £2,000,000. There is no saying what heights of finance might have been reached if the original prospectors had not disappeared suddenly with £100,000 in hard cash, netted from the sale of vendor shares. This discounted the genuineness of the whole affair and culminated eventually in the liquidation of the company without the production of a single ounce of the precious metal.

Similar tales are current of the great majority of the dredging companies, as well as of many other local mining enterprises, and, certainly, this state of affairs has destroyed all confidence in public company operations and seriously retarded the legitimate development of the resources of the country. At any rate, it is an undisputed but regrettable fact that though mines in many localities had, in the past, been worked by private owners at a fair profit, their subsequent acquisition by the public seems to have been the signal for these profits to cease. Of all the companies organized to work a variety of minerals, including those containing gold, silver, copper, and, to a less extent, lead, not one, so far as I am aware, has been known to pay a single dividend.

WORKING CONDITIONS.—In all countries mines have to be worked under great disadvantages and those of the Argentine are especially unfortunate in this respect, being in the majority of instances situated at high altitudes, in localities often entirely destitute of timber and remote from centres of civilization. Labour is not only scarce but is often totally

inexperienced, and, consequently of very low efficiency.

The redeeming features are that the melting snow on the high mountains gives rise to innumerable rapidly-flowing streams, which are available for generating power, usually within easy access of the mines, and that the Argentine government is showing a sincere desire to foster the industry by rendering every reasonable legitimate assistance, in order to bring it, if at all possible, to a condition as flourishing as that of agriculture, which has made the country famous and, financially, probably the wealthiest in the world. By the way, it may be mentioned that mining and agriculture are administered by the same government department, the supposed relation between them arising, presumably, from the coincidence that individual mine-owners are principally farmers, but the hope is expressed locally that mining will rise to the dignity, at no distant date, of having a department of its own.

GEOLOGY.—The area of Argentina is so vast that practically every kind of rock is represented within its confines, of all ages from pre-Cambrian to Recent. But the mineral belt proper forms the wild mountain range to the far west on the boundary of Chile.

It is only now that systematic geological examination of the country is being undertaken by the Government, and the following details of the localities, where the various deposits occur, are given to me by one of the surveyors engaged in official work in the northern half of the Republic.

PRE-CAMBRIAN occurs as the backbone of the Andes, in the form of granite and slate or shale, from at least as far south as the province of San Juan up to Bolivia.

CAMBRIAN deposits are found in the neighbourhood of Salta and Famatina, and **SILURIAN** from Mendoza to Bolivia, and **DEVONIAN**, both inferior and superior, from the north of Mendoza to Brazil.

The principal constituent of these deposits is slate. The fossils present cannot definitely be identified as belonging distinctly to any single period. Volcanic eruptions have greatly metamorphosed the surrounding rocks and render it difficult to recognize the stratification.

CARBONIFEROUS conglomerates, and sandstones, interbedded with volcanic tufas, occur in the greater part of the country.

JURASSIC deposits give evidence of abundant plant life and occur in the Provinces of San Juan and La Rioja, as well as

with other classes of fossils, in Neuquen and Mendoza.

CRETACEOUS (inferior) for the most part Wealden, occurs from Neuquen to Brazil and with petroleum in Jujuy toward Bolivia.

CRETACEOUS (superior) with petroleum is found to a large extent in Rio Negro.

TERTIARY deposits, both marine and terrestrial, are found chiefly in Patagonia and Paraná; but to the

RECENT period belongs the greater part of the Republic, stretching as it does from the Atlantic sea-board across the rolling pampa to the foot of the Andes.

part of its bulk, of infusoria: Professor Ehrenberg has already ascertained in it thirty oceanic forms." "These white beds are everywhere capped by a mass of gravel, forming probably one of the largest beds of shingle in the world," and, as illustrating how comparatively recent has been the formation of this region, he adds "that all this gravel has been transported and probably rounded, subsequently to the deposition of the white beds, and long subsequently to the underlying beds with their Tertiary shells."

The whole of the pampa, or prairie country, is covered with a coating of sandy alluvium, which, though bare of vegetation in the West,



A DERELICT DREDGE AT FAMATINA.

With the geology of Argentine, especially of Patagonia, the name of Darwin is inseparably associated. The expeditions that he and Fitzroy led into the interior, in 1834, were responsible for practically all the valuable information known about that interesting country. Darwin spent considerable time in exploring the great Tertiary formation stretching for some hundreds of miles along the Patagonian coast, in which were contained large quantities of shells, the most common being "a massive, gigantic oyster, sometimes even a foot in diameter."* He, also, has noted that these Tertiary beds are "covered by others of a peculiar, soft, white stone, including much gypsum and resembling chalk, but really of a pumiceous nature. It is highly remarkable, from being composed, to at least one-tenth

is the source of the pastoral wealth of the Republic in the East. Immediately underneath this superficial layer is, most interesting of all, a bed of red argillaceous earth, sometimes 40 feet thick, which Darwin calls "Pampean mud." This deposit is teeming with the remains of gigantic animals, causing Darwin to remark "the whole area of the pampas is one wide sepulchre." Bones of the mastodon and other extinct animals are found wherever this mud occurs, more particularly in the province of Buenos Aires and, frequently, mingled with these, are human bones and other relics that can be identified as bone implements and tools of stone. Many theories have been devised to account for the disappearance of these animals, one being that they were killed by Glacial cold, another that they were overwhelmed by a mighty deluge, while a third

* "Voyage of the Beagle," (Chap. VIII.)

calls for the occurrence of a gigantic simoom. To each of these there are great objections, the most insuperable being that no specimens have been found in a state of perfect preservation, as would naturally be expected under such circumstances, but, on the contrary, many of the skeletons are mutilated. Probably W. A. Hirst, in his 'Argentina,' quoting from Sir H. H. Howorth's 'Mammoth and the Flood,' gives the most irrefutable theory, in the statement, simply, that "some gigantic natural cataclysm swept away alike man and the vast animals with which he lived in these regions." At any rate, whatever be the theories, it is certain that mammoth life was, at one time, very abundant in Argentine, and that it was suddenly obliterated.

Gold in the free state is found in quartz veins traversing granite, andesite, and dacite, and also associated with silver and copper in pyritic deposits within porphyry and slate. Alluvial gold is also found in many deposits of gravel, the discovery of which, some few years ago, created no small amount of excitement, both locally and in England, a circumstance which, as before mentioned, had its sequel in the indiscriminate flotation of numerous dredging companies, many of which were, undoubtedly, organized for purposes other than those of serious work. In many localities a rusty dredge, stranded high and dry on some river-bank, stands as a sorrowful monument to the reckless manner in which the gullible public will throw away their cash during a fit of excitement, and is often the sole asset remaining of a company that may have been floated for hundreds of thousands of pounds. No doubt many of these alluvial deposits, if worked seriously for their gold contents, would prove remunerative, but the crop of scandals that has ensued all over the country in recent years, has created the belief that every dredging proposition in the Argentine must necessarily be a swindle.

Auriferous quartz veins occur in many parts of the Republic; they are generally irregular in width and erratic in value, but conform to the general rule of being richest at the surface. The great majority of these are so small as to be only suitable for private ownership, which may, in a measure, partly account for their failure to be remunerative when acquired by comparatively heavily capitalized companies.

FAMATINA DISTRICT.—Although the Argentine has many indications of becoming at some future time a gold-producer of note, it is plain to the traveller in the mountainous

districts, especially those to the north and west, that in copper production lie the greatest possibilities. At present, however, the only serious attempt at commercial operation in this direction is that being undertaken by the Famatina Development Company, and, if proof be required of the earnestness of the Government to foster the industry, I fancy it is to be found in the liberal concessions granted to this company in the railway freight-rates for its mining supplies and in the low charge made for the transport of ore from the mines to the smelter over the government aerial ropeway. This ropeway has been built at a capital outlay of £175,000, and is being worked for the sole benefit of private mining companies at a scale of charges that scarcely covers the actual operating cost.

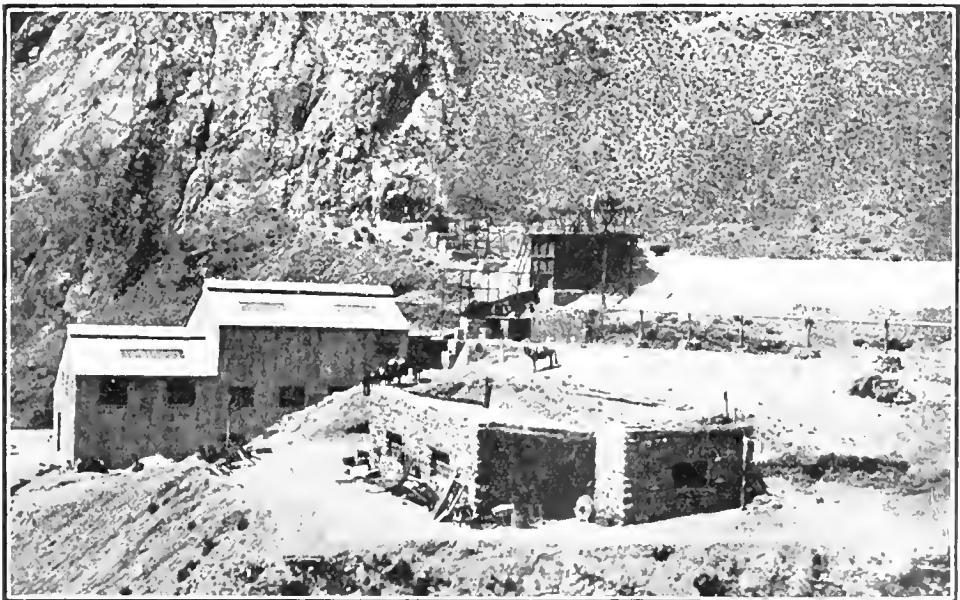
The Famatina properties are situated in the steep mountain ranges bearing the same name as that of the company, at an altitude of from 14,700 ft. to a little over 16,000 ft. above sea-level. Any reference to them is of special interest to British readers, for they are owned in England. They are distant $21\frac{1}{2}$ miles in a straight line from the railway terminus at the township of Chilecito, which is about 700 miles from Buenos Aires. To reach the mines from the railway, several routes are available, the most expeditious being the aerial ropeway, but, as it is by no means uncommon for the transport-cars to be dislodged from the supporting rope, by the violent storms common in the upper mountainous regions, and to be dashed into a valley many hundreds, perhaps thousands, of feet below, the traveller is strongly recommended to seek the less dignified but much safer facilities offered by the docile mule and to journey by one of the several land routes, each of which teems with interest and is by no means lacking in the thrill of adventure.

The various tracks tend to follow the valleys formed by the torrential streams and frequently lead into canyons with walls standing almost perpendicular for hundreds of feet. The rainfall is extremely small, hence practically all the water in the streams is derived from the melting snow on the mountain tops, and, coming from a large area exposed to the disintegrating action of fierce sunlight by day and of intense cold by night, the water carries with it a fine mud, much appreciated for its fertilizing and soil-forming qualities in the irrigation colonies of the lower valleys.

To the prospector, however, the matter of chief interest is that, in many localities, springs of considerable volume issue from the moun-



SMELTING PLANT OF THE FAMATINA DEVELOPMENT COMPANY



CONCENTRATOR AT THE LOS BAYOS COPPER MINE.

tain sides. Many of these, on examination, are found to be simply dilute solutions of sulphuric acid, or rather of acid iron sulphate, containing distinct traces of copper. This, of course, indicates the proximity of extensive copper-bearing pyritic deposits and might also be accepted as a hearty invitation on the part of Nature for closer inquiry.

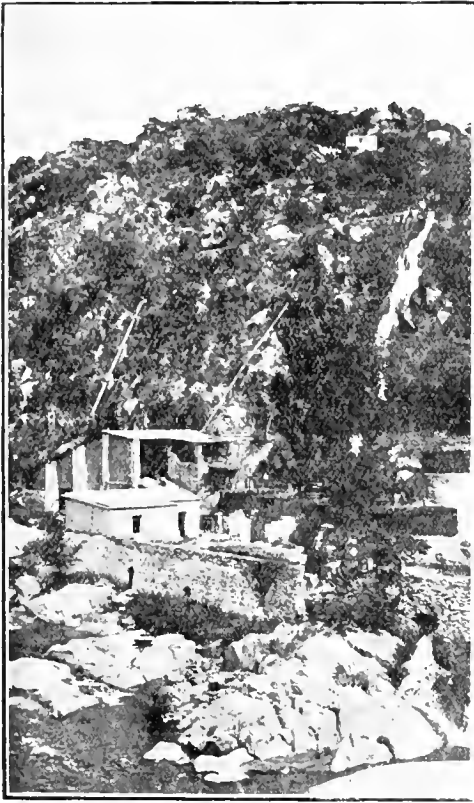
The Famatina ranges undoubtedly contain a number of copper lodes, but of these only a few have been seriously exploited by tunnels driven into the hillsides. The two on which the Famatina Development Co. has concentrated its attention, called the Uplongos and San Pedro, have shown ore-shoots 1200 ft. and 600 ft. in length, respectively, and in width from 3 to 9 ft. and 18 inches to 2 ft. respectively. The ore is a dense pyrite of fairly uniform composition, intensely hard and destructive on the steel drills. It is mined from three levels simultaneously and transported over the aerial ropeway from the mine direct to the company's smelter without any selection whatever, other than the extraction by hand of any waste rock that may have been accidentally broken with it during the process of mining. The ore reserve in the mine is about 120,000 tons and the capacity of the plant is about 250 tons of charge per day, the average value of the ore smelted, according to the published statistics, being 4% copper, 8 oz. silver, and from 4 to 9 dwt. gold. Smelting operations have to be conducted under adverse conditions, especially as regards the supply of coke which has to be brought all the way from England, but, on the other hand, water-power is abundant in the immediate neighbourhood, and at present two turbines generating together 500 hp. are in use.

Close to the Famatina property is another group of copper mines, called the Los Bayos, owned by an Argentine company, in which the lodes appear to have been formed by the deposition in huge cracks of the minerals leached from the enclosing porphyritic country-rock. The gangue consists of quartz, kaolin, and barite. The orebody has been proved for a length exceeding 500 ft., and assays from 2.5 to 3% copper and 8 oz. silver over a width, in many places, greater than 15 ft. The ore is entirely sulphide and is developed on four levels, two of which are separated from each other by a vertical distance of only 10 or 12 feet. This company possesses a small concentrating mill, worked by a Pelton wheel, but, unfortunately for power-generation purposes, harnessed the water from the nearest spring, which is found to have an acidity equivalent

to 5 lb. sulphuric acid per ton, with the result that, during a three months' experimental run, the bulk of the power-plant went into solution. The extraction, by wet concentration, has only averaged about 50% of the valuable contents of the ore, and altogether, during its short career, the company has had its fair share of troubles. For each of these, however, there appears to be an easy remedy, as several other, but suitable, streams are available locally for the supply of power, and the adoption of an oil-flotation method of concentration might overcome the metallurgical trouble. In fact, this mine, which is probably typical of many others in the country, with its pyritic lodes and baritic gangue, and its sulphuric acid well 'on tap,' would seem to be particularly worthy of investigation. The only material to be imported would be the oil, and even this, if persistent reports be true, is now being discovered in the more northern parts of the Republic.

The dispatch of all ore from the Famatina district is now effected over the Government aerial ropeway, an installation constructed in 1907 at a cost of nearly two millions of Argentine dollars and claimed to be the biggest of its kind in the world. It is 21.45 miles long and has a difference in altitude between its terminals of 11,526 feet. For various reasons, chiefly topographical, the usual practice of constructing the ropeway in a straight line was found to be impracticable. A system of dividing it into workable sections, each at a slight angle to its neighbour, had to be adopted. There are in all eight sections, the shortest being little more than 2000 yards and the longest slightly less than 6 miles. The greatest inclination in any one span is 46% and the working capacity of the installation is 400 tons in 10 hours. The bulk of the tonnage handled comes from the extreme upper terminal at the Famatina Development Co.'s mines and goes to that company's smelter, situated at a point 15.85 miles along the route, the difference in altitude between the points of collection and delivery being almost exactly 10,000 feet. Even to the layman, it appears reasonable to assume that during the operation of dropping 40 tons per hour through this enormous height, sufficient energy is being generated to satisfy the power consumption of even a Government institution of this class, but, for some reason at present obscure, each pair of adjacent sections is being operated by a separate steam-power plant, specially installed, presumably for no other purpose than to assist the load in its career down-hill. The adoption of steam for this purpose, too, is all the more extra-

ordinary, seeing that both fuel and water have to be obtained at great expense from sources remote from each point of consumption, and that, even if an external power supply were



Paso del Molle Mill and Cyanide Plant.

proved a necessity, there is an abundance of water, for the generation of electricity, available along almost the entire route. With each steam-plant is installed a powerful brake, and it is no uncommon occurrence to find engine, boiler, and brake all being operated simultaneously, the intelligent employee in charge explaining that with everything being worked to its greatest capacity, including the supply of steam to the engine, were it not for the application of those powerful brakes the whole installation would simply get beyond his control.

Prior to the installation of the aerial tramway and before the advent of company ownership, all the ore was bagged and transported by mules to be treated at one or other of the little private smelters at the foot of the mountains. Of these, probably the one of greatest interest is that erected more than twenty years

ago, at a place called Corrales, by Fouert, an unknown but progressive metallurgist, who recognized the advantage of producer-gas for reverberatory smelting and did such efficient work that his slag is found to assay only 0.5% copper, although the ore then being smelted contained from 7 to 12%, and was frequently much richer. This plant consisted of a water-sealed producer, a reverberatory capable of holding a charge of about one ton, and a brick stove built on the best regenerative principles, the whole being entirely home-made, even to the fire-bricks, which were hand-cut from a sandstone ledge in the immediate neighbourhood. Each furnace charge, I understand, required about six hours for complete reduction. Fouert's success is all the more remarkable when it is known that the only fuel available for his gas-production was simply the wild mountain bush locally termed *jarilla*,



On the Trail.

which, though highly resinous, is so small that some difficulty is experienced in obtaining any one stick of greater diameter than a single inch. I believe it was the owner's intention

to replace the then existing plant by one of much greater capacity when, in 1896, his death put an end to further operations and closed a career that, in a wider metallurgical field, would have brought him at least a fair share of fame, if not of fortune.

To me, the discovery of the ruins of this old plant, away in the wilds of South America, was of special interest because of my having been just then re-reading the presidential address of Professor Gowland, given before the Institution of Mining and Metallurgy, in which the author foresaw that the "extended application of producer-gas as fuel in copper reverberatory furnaces" would be one of the "advances made before the end of the next half-century." Apparently, therefore, Fouert was as much impressed with the merits of the gas-fired reverberatory then as Professor Gowland is now, and possibly his success under such extremely adverse conditions, more than twenty years ago, is worthy of the careful study of metallurgists whose smelting operations have to be conducted in similar inaccessible localities at the present day.

CONCLUSION.—So far, the Argentine, as a mining region, has proved a bitter disappointment, especially to those who bought scrip during any of the recent 'booms' and have continued to retain their holdings, but this state of affairs arises, not so much from lack of intrinsic merit on the part of the mineral resources of the country, as from lack of real mines to off-set the many 'wild-cat' companies that invariably present themselves during an effervescent fit of mining excitement, and from maladministration and somewhat unsavory financial manipulation on the part of the inner circle controlling the companies. The past has been bad and what is now wanted in order to give the industry a standing of respectability, is for but one mining organization legitimately to earn and pay a regular dividend, no matter how small. The field for practical work is great, and, if I may judge from personal observations made during a few months' tour, I venture the opinion that, in many localities, the indications are favourable to the existence of orebodies, such as, in better known and more readily accessible parts of the world, would command a fair share of serious attention. It is true that the conditions under which these deposits will have to be worked are adverse, but what mining country is free from its drawbacks and where are the handicaps that cannot be surmounted through the skill, pluck, and perseverance of the engineer, if backed by adequate capital

and convinced that the extent and value of the material to be won will warrant the associated outlay?

Foreign capital for Argentina is not an absolute essential, other than to give the industry the necessary impetus, but, it will, more than likely, fall to the lot of some foreign company first to demonstrate that mining is not altogether a game to fleece gullible shareholders. When this is achieved, there will be no lack of local financial support from every part of the Republic, for, if there is anything that really appeals to the Argentine resident, it is something of a highly speculative nature.

The Government, in its desire to foster the industry, should, profiting by past experience, first devote itself to preventing a recurrence of the scandals and abuses with which the history of mining in the Republic is pregnant. It would be well to pass legislation so as to penalize those gentlemen with whom the country, even now, is swarming, who, through a fertile imagination and flamboyant reports, confine their 'mining' to the pockets of the public, concerning themselves solely with the floating of companies on the market, to the neglect of everything that relates to the sinking of the holes in the ground. Having seen so many instances of the class of 'mining' to which I refer, in my recent tour, I confess to possessing an insatiable desire for power to award those responsible with a term of years' hard labour so as to, as it were, let them work out their own salvation on the very properties over which they had lavished their alleged enthusiasm. The change to honest toil could not but be beneficial to themselves, and their labours would certainly be useful to the country, for, more than likely, many new genuine mines would be discovered, and here, as elsewhere, the rank 'wild-cat' might surprise every one connected with it, especially its owners, by becoming transformed into a legitimate source of dividends.

The Third Section of the Report of the Geological Survey of South Africa for 1911, which has just arrived in this country, contains several interesting papers. One of these, dealing with the coal resources of South Africa, we abstract in our *Précis of Technology*. Students of the geology of the Rand will welcome E. T. Mellor's paper on the Lower Witwatersrand System on the Central Rand, while those who follow the tin industry of the Northern Transvaal will be glad to have the report on a portion of the Rooiberg district, by the director of the Survey.

PRÉCIS OF TECHNOLOGY

Intermittent Cyanidation.—The tendency in the cyanidation of fine sand and slime is invariably to adopt the continuous system, as any stoppage for settling and decantation causes a clogging of the apparatus and pipes. On the other hand, the continuous system has a great drawback, due to the individual particles not receiving the same length of treatment. There is no guarantee that the particles will stay in the apparatus long enough, or that they will be discharged when they have parted with their gold. In fact, the heavier and coarser particles pass through in the shortest time; thus the part of the ore requiring

The air-jet, on being started, will institute circulation of the solution down between the two columns and up through the central column, whereupon the outer column is raised, allowing the pulp to enter into the circulation. This agitator has never failed to get the pulp into a condition of suspension and without the aid of additional air.

In the system under consideration, a thickener to precede the agitators is not necessary. The agitator is provided with a baffle which gives a circumferential quiet zone when pulp is being run in and when agitation is taking place, the overflow going to cone settlers. When a charge is sufficiently thickened in the agitator, the pulp is switched to another agitator, and agitation started in the charged tank. During agitation, barren solution may be run in to lessen the gold contents and also to vitalize the solution in the tank. The extraction being completed, the outer column is screwed down, agitation suspended, pulp settled, solution decanted, and washes repeated as many times as is advisable, depending on the richness of the ore. The settlings from the settlers and clarifier are drawn off intermittently to the washing settler, or agitator, and washed.

Extracting Gold by Volatilization.—In our December issue we made a short reference to the process adopted at the Gwalia Consolidated, in the East Murchison district, Western Australia, for extracting gold by volatilization. Mr. Howe describes this process in the December issue of the *Monthly Journal* of the Chamber of Mines of Western Australia. It will be remembered that the Gwalia Consolidated ore is refractory, and that it is not of sufficiently high grade to stand the cost of roasting and cyaniding. Mr. Howe's process has the advantage of great simplicity and low working cost, and moreover an efficient extraction is obtained, usually from 92 to 94 per cent.

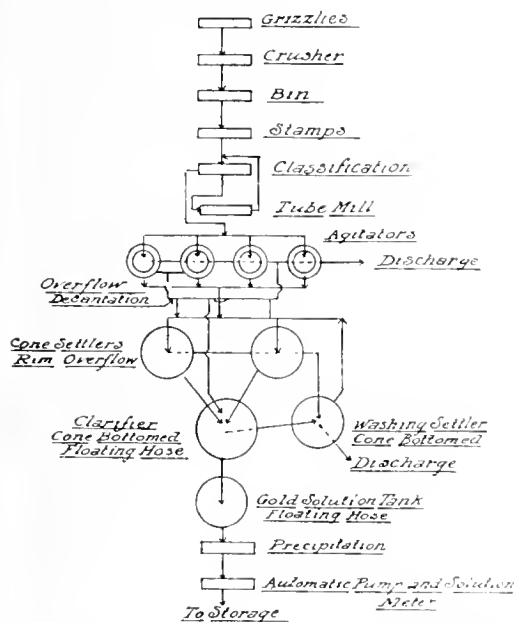
The process consists in roasting the ore with a small percentage of salt, whereby the gold is volatilized. The fume is led through chambers and drenched with water, which dissolves the lime, arsenic, and iron salts, while the gold is left suspended in the solution as a black powder. The solution is pumped through a filter-press and returned to the chambers to be used again. It is not absolutely necessary to grind the ore very fine before roasting. Ore as coarse as 20-mesh has been successfully treated; but the finer the ore the quicker the volatilization. Thus the same ore ground to pass a 100-mesh screen is treated in ten minutes, to 40-mesh in thirty minutes, and to 30-mesh in fifty minutes. It will, therefore, be found, in most cases, cheaper to grind the ore fine, than to keep it for a prolonged time in a furnace at a high temperature. The salt may be mixed with the ore dry, or the ore may be wet-crushed in salt water from the mines or salt lakes, and subsequently dried. If the ore is given a rough preliminary roast before the addition of salt, 1 to 2% is sufficient for most ores; but if mixed with the raw ore more salt, say, 3 to 4%, is necessary.

The furnace used is the simple brick-lined rotary type without ribs or other projections inside, with a constant feed at one end and a discharge at the other. The temperature required is about 1000° C. (orange to yellow heat); the temperature, in fact, attained in a muffle furnace during cupellation. A higher temperature than this sinters the ore. This is no disadvantage if it occurs at the discharge of the furnace, but if too high a temperature is carried back into the furnace the ore sinters at this stage and volatilization ceases before the ore is ready for discharge. Sintering for even the last quarter of the furnace length only reduces the gold volatilized by about 5 to 7 per cent. A low tempera-

Intermittent Decantation System

Flow Sheet

No Filtration



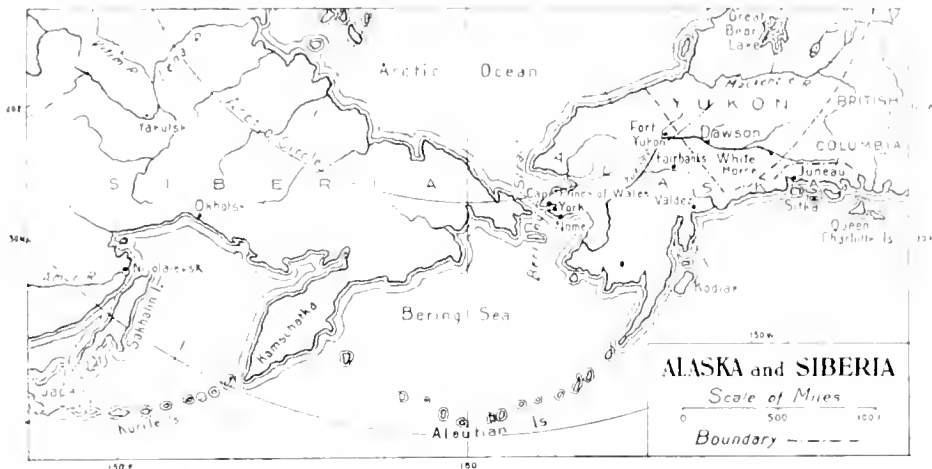
the longest treatment gets the shortest, and vice versa. The *Mining and Scientific Press* for February 8 reprints a paper published in the *Colorado School of Mines Magazine*, in which Leon P. Hills, manager of the United Mines cyanide plant at Tuolumne, California, describes a form of agitator, by the use of which the intermittent system of treatment is successfully conducted. By this method the fine particles receive a shorter treatment and the heavier and coarser the longer. The agitator is a modified Pachuca, the central fixed column being surrounded by a vertically adjustable column of a few inches greater diameter. This outer column, by means of a screw at the top of the tank, can be moved from a position where the lower end of the column is in contact with the sides of the cone, to any predetermined point above that, the upper extremity of the column always being below the surface of the solution. During the time agitation is suspended and settling is taking place, the outer column is in its lowest position, thus excluding the pulp from settling round the inner column and air-jet.

ture is fatal to good results, as little action takes place below a bright red heat. It is advisable to use oil or gas firing in the furnace, in the first place because the temperature is more easily under control, and again, because the time, under this mode of firing, is not contaminated with soot as it would be from a wood fire. Only a small draught, just sufficient to carry the fume through the furnace, is required. In this way the heat is well conserved within the furnace, and the great loss of heat carried into the flues, so characteristic of the many roasting-furnaces, is avoided. A rabbled furnace of the reverberatory type is not suitable for this process. The water used in catching the fume becomes charged with sulphurous and a little hydrochloric acid, both of which are helpful in taking the salts of the base metals into solution. Owing to the constant circulation of water, no great heat is experienced in the absorption chambers, and wood can be used in their construction.

The laboratory tests to try the suitability of an ore to this treatment are simple. Two assay tons of the finely-ground ore, of which the gold content is known,

of view of the object of the experiment, and it was not until Mr. Howe suggested that the 'loss' was really a 'gain' that advantage was taken of the discovery.

Tin in Alaska.—Some time ago we gave particulars of the only tin-dredging proposition in the United States, namely, that at Buck Creek, Alaska. These particulars were printed as a short appendix to Charles Jamn's article on 'Gold Dredging in Alaska and the Yukon' that appeared in our issue of January 1912. Buck Creek is near Cape Prince of Wales, the most westerly point in Alaska, and it is 110 miles in a north-westerly direction from Nome, famed for its auriferous beach-deposits. The tin-placers are 14 miles up Buck Creek from York, and are owned by the York Dredging Co., of which W. W. Johnson, of San Francisco, is the leading spirit. *The Engineering and Mining Journal* for February 1 contains an account of the work that is being done. The dredge is of the usual Californian type such as is used in gold-dredging. The buckets are open-linked with a capacity of 2½ cu. ft. The lips are of nickel steel, but manganese steel will be substituted later. The capacity of the dredge is



are mixed with 5% of salt. Either common salt or salt evaporated from mine waters may be used. It is advisable to commence experiments with 5% of salt and gradually work back to find the minimum amount of salt necessary for any particular ore. The mixture is spread evenly to cover a 4-in. or 5-in. roasting dish, and then placed at the back of a muffle already heated to a good cupellation temperature. It should remain at this temperature for half an hour without rabbling, or any further attention, and can then be removed, cooled, mixed with the usual fluxes, and assayed in the ordinary manner. The percentage of volatilization of the gold is high, generally over 90 per cent. The charge, on being removed from the muffle, should present the reddish appearance of roasted ore. It will probably have caked slightly by the action of the salt, but can be readily crushed with a spatula. Should it appear hard and sintered, the temperature has probably been too high, and a low volatilization result will ensue. Care must, however, be taken to keep the muffle hot enough.

Mr. Howe records the origin of the discovery of the process. In 1910, A. T. Fry, a chemist and assayer at the mine, while experimenting with various processes of possible application, observed that the ore lost its gold by roasting with salt. This volatilization was considered a serious disadvantage from the point

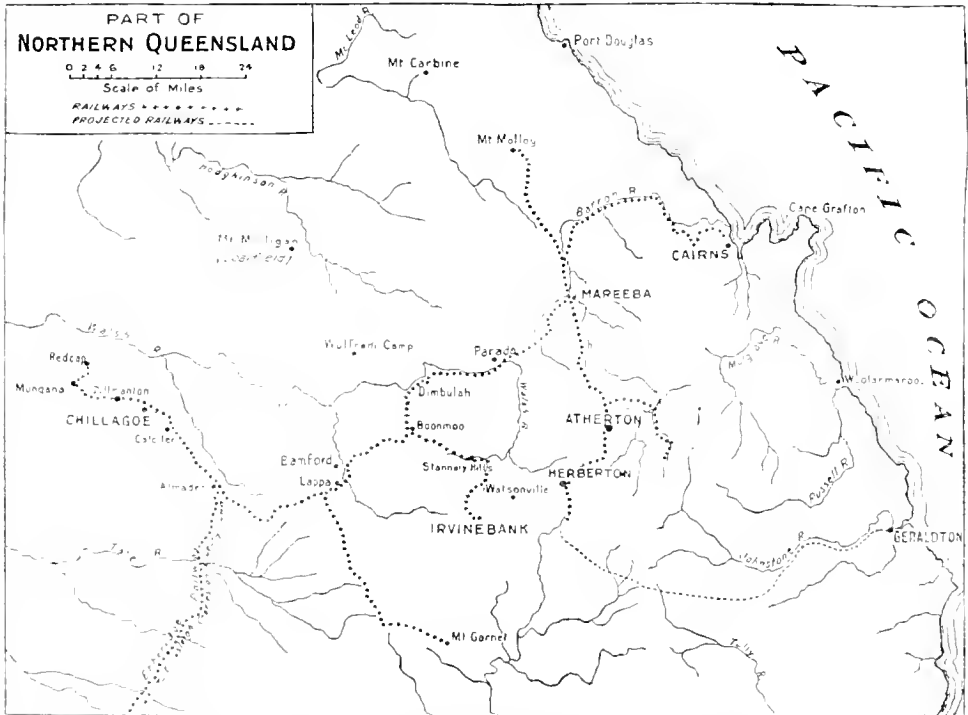
1200 cu. yd. per 24 hours. This maximum is not pressed, and a better recovery of the cassiterite is effected if only 950 to 1000 cu. yd. is sent through during the day. The dredge commenced operations in September 1911, and it was possible to make a trial run for 30 days before the frost supervened. Work was resumed on June 29, 1912, and was continued throughout the season for 107 days until October 14. During this time, 175 tons of concentrate was obtained, the recovery being 6½ lb. per cubic yard of gravel. The width of the channel is from 100 to 160 ft., and in parts the content is much greater than the average. Sluicing methods would no doubt give a higher return per yard, because then the work would be confined to the richer portions, but the total product would be less and the working cost greater, as compared with the results obtained by the dredge. The engineers point out that the cost of dredging tin is greater than in the case of gold, as a clean-up is necessary six or eight times during the 24 hours, as compared with a similar operation with gold once a week or once a month. Moreover, the cost of transport of the recovered product is much greater. It costs \$1 per ton per mile by horse waggon from the workings to York, and by boat from York to Nome from \$6 to \$10. From Nome it is necessary to ship to Seattle in Oregon at a cost of \$4 per ton, and thence to Liverpool at a cost of

\$8.50 per ton. Thus the minimum cost of sending the concentrate from the dredge to the smelter is \$32.50 per ton.

Wolfram in Queensland.—The *Queensland Government Mining Journal* for January contains a report by Lionel C. Ball, assistant government geologist, on the wolfram, molybdenum, and bismuth deposits in Northern Queensland. For some years the outcrops have been worked, but recently the production has decreased, owing to the fact that the variability of the veins has been unfavourable to deeper working. The chief centres are Wolfram Camp and Mount Carbine, and deposits have also been worked at Bamford, near Lappa, and at Parada, between Dimbulah and Marceba. The Irvinebank company, well known for its

which the granite intrudes. In Wolfram Camp the deposits are patchy and occasionally rich. On the other hand, the Mount Carbine deposits show a much more regular distribution of wolfram, so that the Irvinebank company has begun to undertake work in a much more systematic manner. The concentration of the molybdenite is effected by oil-flotation.

Migration of Gold Solutions.—In *Economic Geology* for December, Victor Lenher discusses various theories that have been propounded to explain the migration and re-deposition of gold in the rocks and ore deposits, and he proffers the alkaline sulphides, sulphites, and aurous compounds, as important factors in this migration. Almost all previous investigators have assumed that chlorine or some chlorine compound has



activity in tin, has exploited the deposits in all these districts, and produces both wolfram and molybdenite concentrates, but the results have not been always profitable. The Wolfram Camp mines at present produce about 16 tons of wolfram concentrate and 7 tons of molybdenite concentrate per month. The most recent venture is that of a French company, called 'La Société Française des Métaux Rares,' which has been purchasing dumps and is erecting dressing plant. At the present time the company is not engaging in any mining operations. The ores of tin, wolfram, and molybdenum are found in quartz veins in the contact of intruding granite with schists and slates or in the adjacent granite. The relative proportions of the metals vary, and in the localities named, tin is practically absent. Molybdenite is only found below the zone of oxidation, and is always accompanied by pyrite. The granite containing the ores is usually greisenized, but in the Mount Carbine district the wolfram is associated with pegmatite. The orebodies are in the form of pipes, when found in the granite, but they are in the form of tabular fissure-veins in the rocks into

been the solvent, and that the re-precipitation has been caused either by a decrease in temperature, by the presence of ferrous sulphate, or by a sulphide such as pyrite. Other solvents have been proposed, such as the cyanides, and various concentrated acids, but the conditions requisite could hardly occur in nature. Records relating to the use of alkaline sulphides are meagre. Glauber was aware that gold could be rendered soluble by fusion with liver of sulphur, that is, a mixture of polysulphides and sulphate of potassium, and Stetefeldt has used the thiosulphate process, which is analogous. But it was not until 1872 that Skey, a New Zealand chemist, suggested the alkaline sulphides as the dissolving agent in the formation of nuggets. Subsequently Egleston (1880) and Becker (1887), in the United States, and Liversedge (1892), in New South Wales, amplified and confirmed Skey's opinions. Mr. Lenher has recently conducted a series of tests for the purpose of further investigating this problem, and his most important addition to our knowledge consists in the discovery that the gold is not precipitated from these solutions by charcoal or iron

pyrite, as is the case with chloride solutions, also that the gold is precipitated slowly by exposure of the solution to the air, under which condition the alkaline sulphide oxidizes. Further, the alkaline sulphide solutions will dissolve gold-leaf in the presence of pyrite. It is therefore possible for gold to have been transported in such a solution through a bed of pyrite, the solution even becoming enriched, during its passage, by such gold as might be associated with the pyrite. The solution, on subsequently arriving at a weathered zone where free acid is present, or at a zone where oxidation of the alkaline sulphide was possible, would re-deposit its gold.

Mr. Lenher proceeds to describe the action of sulphite solutions on gold. Von Haase in 1869 described the formation of a double sulphite of gold and ammonium, and showed that neither pyrite nor metallic iron attacked it. Mr. Lenher finds that the gold is precipitated from the solution by contact with acid. On the other hand, he finds that the double sulphites of sodium and potassium are not stable in contact with pyrite, but part with their gold in a few minutes. Also, the presence of these sulphites in the ammonium salt renders the latter equally unstable. On the whole, therefore, the author is inclined to dismiss the sulphites as possible transporters of gold.

Another set of experiments undertaken by Mr. Lenher relate to the production of aurous chloride, and its greater resistance to the precipitating action of pyrite than that possessed by the auric salt. He finds that this reduction of the chloride from the auric to the aurous state can be effected by sulphurous acid gas, but that the reaction is apt to proceed farther and end with the precipitation of the gold, unless a large proportion of an alkaline chloride is present. With a proper regulation of the amount of alkaline chloride in the solution, the gold can be obtained as aurous chloride. This solution is comparatively stable in contact with pyrite. When it is exposed to the air or other oxidizing agent, the gold is slowly precipitated. Here again, the author is not inclined to believe that this reaction is as likely to provide the actual explanation of the migration of gold in nature as the alkaline sulphides. We may remark that Mr. Lenher's paper contributing to our knowledge on this subject is of considerable importance.

Rand Ore at Depth.—The *South African Mining Journal* reverts, in its issue of January 25, to the often discussed theory that ore deposits become poorer in depth. While admitting that this is the general experience with deposits formed by solutions passing through crevices and zones of shattering, or by the natural concentration of rock constituents, it calls for due consideration of the supposedly different circumstances in which the Rand deposits originated. Though many geologists have investigated the Rand formations and have speculated as to their origin, it is generally felt that the actual explanation has not been found. An excellent resumé of present knowledge was given by R. B. Young, in a paper read before the Geological Society of South Africa, an abstract of which appeared in our issues of March and April, 1911. Our South African contemporary holds that, with the exception of the rich outcrop in the central Rand, the Main Reef series as a whole exhibits a remarkable uniformity of gold content, though naturally both on the dip and laterally there are variations in value. As regards the argument based on the gradually diminishing yield per ton, it holds that this decrease is explained solely by the decreased cost of operations permitting a greater proportion of the deposits being worked profitably. Our contemporary

brings forward several instances of comparatively high grade ore found in deep levels recently. At the Consolidated Main Reef in the middle west Rand, No. 3 shaft, sunk vertically, intersected the Main Reef series at 2365 ft., where developments have proved the ore to be worth 17½ dwt. over a stoping width of 48 inches. At the New Modder, in the far east Rand, the vertical shaft cut the deposit at 2158 ft., where the assays are 13.2 dwt. over 48 inches. In the Modder Deep, the two shafts cut the deposit at 2990 ft. and 3007 ft. respectively; in one case the assay was 8.84 dwt. over 126 inches including partings, and in the other 7.75 dwt. over 47 inches in the hanging-wall leader. These results are not proffered as proof that the deposits do not generally maintain their value in depth, but are put forward to strengthen the plea for the suspension of judgment as to the ultimate explanation of the nature of the Rand ore deposits.

Coal Resources of South Africa.—Part 3 of the Annual Report for 1911 of the Geological Survey of the Union of South Africa contains, among other matter of value, a useful summary of the coal resources of the Union. As is well known to students of geology, the youngest series of rocks in South Africa, with the trifling exception of small Cretaceous deposits in coastal districts, belong to the Karroo System. These rocks do not correspond to the European sequence, though their analogues are found in India, Australia, and South America. As far as can be judged, their period extended from the later Carboniferous, through the Permian, to the Trias. This system contains the coal measures of South Africa. The Karroo System attains its greatest development in the Cape Province, reaching a maximum thickness of 18,000 ft. It is also well developed in Natal, Zululand, Orange Free State, and along the eastern borders of the Transvaal. Toward the central Transvaal the system thins rapidly, and the areas occupied by it in the southeastern Transvaal are isolated, between extensive areas of older rocks that have been exposed by denudation. Over the larger portion of the state, even in the districts where coal is extensively mined, the system is comparatively thin. In the Heidelberg district, the thickness is about 600 ft.; at Witbank, from 200 to 450 ft.; and in the far east Rand less still. On the other hand the coal measures of the Transvaal are more extensive than those of the other provinces.

The system consists mainly of shales, sandstones, grits, and conglomerates, and has apparently been deposited chiefly by fresh-water agencies. The strata associated with the coal-seams in the Transvaal include sediments of every degree of coarseness from conglomerates to shales, the grits and sandstones being predominant. Underclays are rare, and the coal generally lies between strata of coarse thick-bedded sandstones. As a rule the coal-measures occupy the highest portions of the country, extending over it as a horizontal sheet. They are consequently easily mined by adit, and if by sinking, the shafts are usually less than 200 ft. deep and rarely exceed 400 ft. The conditions under which the coal-seams of the Transvaal were formed differ from those of the other chief deposits of the world. There were no vast expanses of level bog-land and swamp, but the land-surface was irregular and was covered in places with extensive sheets of glacial debris. In some districts the coal was formed in isolated basins, on the margins of which ridges of older rocks rose to 200 ft. above the general level. Thus not only does the thickness vary greatly, but the deposits have been fouled by irruptions of muddy sediments. These conditions have led

to an opinion, occasionally given, to the effect that the coal deposits were of drift origin. In the Wit-bank-Middelburg district, which is the leading producer, there are five seams of coal varying in thickness from 1 to 20 ft., and the average of the seams worked is 10 ft. On the other hand the seams in the Cape province are thin, seldom exceeding 2 ft., and they are interstratified with black shale; moreover, they are high in ash, 20% not being uncommon, and they are semi-anthracitic, due to the presence of many in-

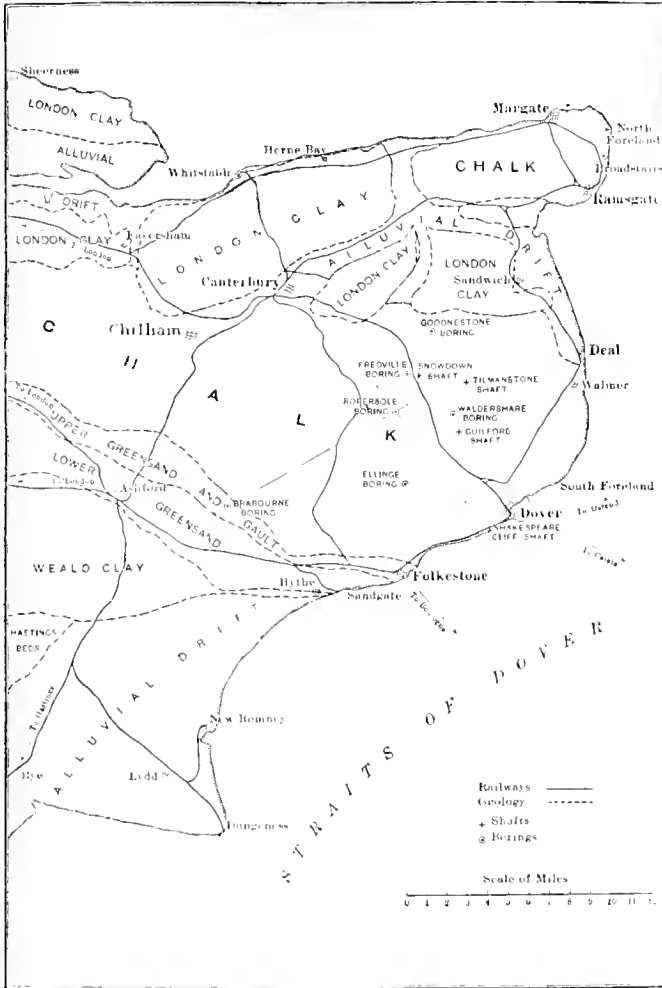
	Area Square Miles	Thickness in feet	Estimated Tonnage
Transvaal.....	5000	6	36,000,000,000
Natal	1000	7	9,400,000,000
Zululand.....	1250	4	6,000,000,000
Orange Free State.....			
Cape	1000	4	4,800,000,000
Basutoland.....			
Swaziland			

The present methods of exploitation admit of the mining of about 55% of the known deposits. The quality is very variable, and the percentage of ash varies from 6 to 30%. With most of the coal actually used the variation is between 10 to 15%. It will be seen from the above table that the coal wealth of the Transvaal is a notable feature of the economic problem in South Africa.

Kent Coal.—In its issues of February 7 and 14, *The Colliery Guardian* gives particulars of the work done at the Snowdown colliery between Dover and Canterbury, by the company controlled by Arthur Burr. We gave a general history of this coalfield in our issue of July last year. The coal-seam at 1490 ft. is now being developed at the Snowdown, and it has been christened the 'Beresford' seam. It averages 6 ft. in thickness, but it has several fire-clay partings which reduce the net thickness of the coal to 5 ft. One of the partings is a foot from the roof, and there are several thin bands near the floor. The coal between the top parting and the roof is of better quality than the rest, and in driving it is left in place, to be subsequently removed separately when the lower coal has been hoisted. The seam is approximately horizontal, as far as worked. The character of the coal to be found in Kent has been a matter of considerable uncertainty, and little authentic information has hitherto been obtained or published. The report by George R. Hislop, printed by our contemporary, is therefore of interest. It will be seen that the coal is specially suitable for gas-making, and incidentally for the manufacture of coke; while owing to the small percentage of sulphur it will be applicable for household purposes. It cannot compete with Welsh coal for steam-raising purposes.

The following is Mr. Hislop's report:

The coal possesses considerable lustre and brownish-black streak; fracture partly defined by organic remains, and partly coarse, angular, and crystalline; cross-fracture small cubical, semi-resinoid, and crystalline; partly finely columnar between the several lines of stratification, and with shining planes in the natural partings; moderately cohesive and very compact, under heat it intumesces and agglomerates; coke, silvery; colour of ash, brown; thickness of seam, 47 inches; mean specific gravity of the coal, 1.276 (water 1000); weight of one cubic foot, 79.75 lb.



The Kent Coalfield.

trusions of dolerite in the near neighbourhood of the seams. In Natal the coal seams have been intruded by numerous dikes and sills, with the result that they are anthracitic in character; nevertheless the horizontal position of the beds, common throughout South Africa, has not been altered.

The extent of the South African coalfields is little known, for extensive prospecting is not warranted owing to the limited market and the excess of present supply. The authorities of the Survey make a tentative estimate as follows:

Volatile matter containing 0.44 of sulphur (carbon 62.50)	21.02
Coke consisting of sulphur 28 ash 0.071	68.91
Water expelled at 21° F.	2.04
	<hr/> 100.00

Gaseous Products.

Gas per ton of coal at 60° F. and 30 in. barometer	12,465 cubic feet
Gas from one cubic foot of the coal	438.43 cubic feet
Specific gravity of the gas (air 1000)	4.30
Hydrocarbons absorbed by bromine	4.00 per cent
Durability of one cubic foot by 5-inch jet flame	35 min., 12 sec.
Value of one cubic foot of gas in sperm-candles	403.2 grams
Value of gas from one ton of coal in sperm	747.98 lb.
Illuminating power of gas in standard candles (per No. 2 Met. Burner)	16.8 candles.
Sulphuretted hydrogen (H ₂ S) in foul gas	1.90 per cent
Carbonic acid (CO ₂) in foul gas	3.25 per cent
Carbonic oxide (CO) in foul gas	6.25 per cent
Sulphur eliminated with volatile products	9.85 lb.

Liquid Products.

Tar per ton of coal	9.65 gallons
Ammoniacal liquor per ton of coal	1.75 gallons
Strength of ammoniacal liquor	3.0 degs. Twadd.
Hydrometric water per ton of coal	5.37 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	2.56 per cent

Solid Products.

Coke per ton of coal	1547.25 lb.
Carbon in the coke	91.20 per cent.
Ash in the coke	8.80 per cent.
Sulphur in coke per ton of coal	6.27 lb.
Heating power in 1 lb. of coke (water from boiling point into steam)	12.51 lb.

Metallurgical Plant at Shamva.—The *Rhodesian Mining Review* for January 29 contains a description of the metallurgical plant now being provided at the Shamva gold mine in the Abercorn district of Rhodesia. We have referred many times to this deposit. Our contemporary reports that the complete plant should be running about the end of the year. The mine is situated on a large hill, and consequently considerable advantages will accrue in regard to working costs, chiefly due to the fact that an enormous tonnage can be mined and delivered to the reduction works at a very small cost. The ore will be drawn from the adits by means of petrol locomotives, and deposited in a large storage bin; from this bin the ore will be fed into trucks and lowered by gravity to grizzlies placed over three No. 7½ Gates stone-breakers; after the oversize has been reduced in these, the whole product, fine and coarse, will be delivered to a belt conveyor, which discharges into trommels, where the fine material will be eliminated and sent direct to the tube-mills, while the oversize will be deposited into a bin feeding Nissen stamps of 2000 lb. each, using ½-in. mesh screen, the ore being crushed in cyanide solution. After leaving the stamps the pulp will gravitate to the feed-cones of 8 by 22-ft. tube-mills, using Osborne liners. The underflow of the cones will pass through the tube-mills, over short copper-plates and blanket tables, and thence to a centrifugal pump to be elevated to the cones again. The overflow of the tube-mill cones will pass direct to eight sand-cones superimposed over four others, in which the sand will be removed by classification, and, mixing with the barren solution from the slime-plant extractor-boxes, will gravitate to eight 50 by 8 ft. 6 in. sand-collecting and leaching vats. The slime and solution overflowing the sand-cones will flow to five 35 by 10 ft. Dorr thickening tanks, part of the clear overflow of which will run to the extractor-boxes, and a portion back to the mill-supply tank. The thickened pulp from the discharge of the Dorr tanks will be pumped to five 45 by 10 ft. Pachuca vats connected in series, where, after air-

agitation, the slime-pulp will run to the storage agitators connected to the Butters filter-plant. The latter will consist of 336 leaves and is designed on the gravity system of working. All solutions will be precipitated in ordinary zinc-boxes, and the gold-slime will be smelted in two Morgan gas fired tilting-furnaces.

The water supply for the mine will be drawn from the Inyanga river, and pumped, by means of an electrically driven 3 throw pump, through eight miles of 12-in. pipe. The power-plant will consist of six Babcock & Wilcox water tube boilers, having a total evaporation of 90,000 lb. of steam per hour. The coal, after being discharged from the railway wagons, will be automatically conveyed to overhead bunkers feeding mechanical stokers. These boilers will supply steam to three 1250 kw. Parsons turbo-generators, which will provide power for the whole of the reduction plant, and for one 5000-cu. ft. Pokorny-Wittekind turbo-compressor for rock-drill work. The capacity of the plant should be about 50,000 tons per month, and the cost of treatment is expected not to exceed 4s. 6d. per ton.

Constructing Shafts by Rising.—*Mines and Minerals* for October last contains an article by L. L. Wittich, describing the cutting of a shaft by rising, at the Nowata lead and zinc mine in Missouri. The shaft was to be sunk to a depth of 210 ft. from the surface, and the work was to be done on contract. The lowest bid was 15½ dollars per foot for a shaft 7 by 5 ft. clear. The total cost was therefore \$3255. The manager, H. Correll, considered this too high, so decided to rise from the 210-ft. level instead. The presence of a vertical drill-hole decided the exact position of the shaft. Through this hole a ½-in. cable was passed, carrying at its lower end a platform to hold the men, as shown in the accompanying illustration. The results justified the means, for the total cost was only \$1273, or \$6.06 per foot.

The platform was built of 2 by 4 in. and 4 by 4 in. timber, and measured 4 ft. 8 in. by 6 ft. 8 in., thus leaving 2 in. in the clear, all around, when the platform was hoisted into the rise. The aggregate weight of the platform, operators, and equipment was 800 lb., divided as follows: Stopping drill, 110 lb.; steel, 50 lb.; two operators, 300 lb.; platform, 340 lb. Starting the shaft in the roof of the drift was much the same as starting it in solid ground at the surface. The 5 ft. by 7 ft. space was marked out, with the drill-hole as its centre, and the work of blasting the rock started. The platform was supported by four iron bars, fastened at the corners of the platform, and meeting at a point above the centre, high enough to permit the operators to work freely. A hook permitted the cable to be detached from the platform, thus when shots were fired, the platform was lowered to the floor of the drift and pulled to a point of safety, to be out of the way of falling rock, while the detachable cable was hoisted up the drill-hole in order that it might not be damaged by the blast. From the time the first round of shots was placed in the roof of the rise until the shaft was completed, cribbing included, 52 eight-hour shifts were required. This was about one third of the time usually required for sinking a shaft of similar dimensions. The cribbing was installed from the bottom upward.

In rising, 14 holes were driven to a depth of 5 ft. in the roof, as shown in Fig. 2. Six of these corresponded to the ordinary sump-holes used in sinking a shaft from the top down, while eight corresponded to the cut holes, four of these being driven near the corners and four along the edges, midway between the corner holes. During the rising of the first 100 ft., the

shots were fired from below, the electrical shot-firer being stationed in a drift. During the remainder of the work, the shots were fired from the surface. A signal cord down the drill-hole enabled the operators to signal to the hoisting engineer.

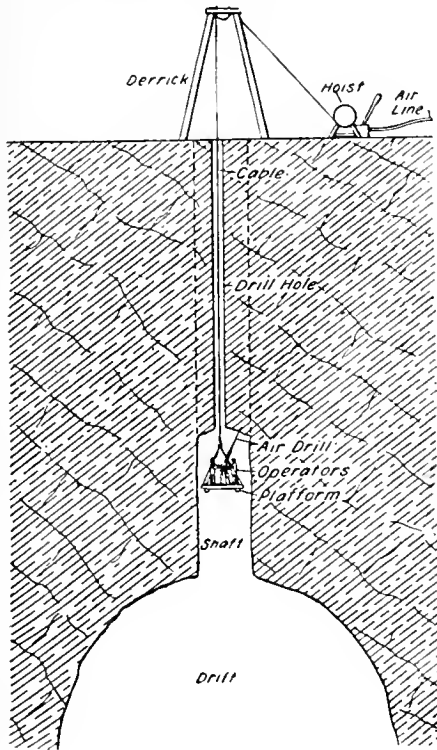


Fig. 1.

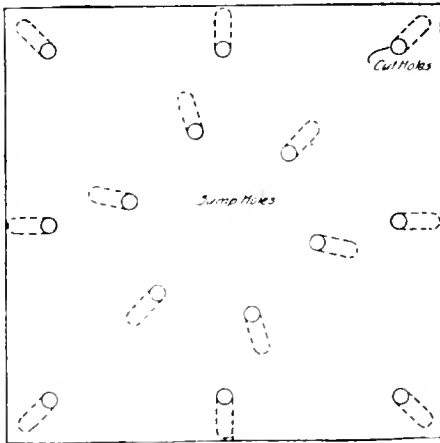


Fig. 2.

The 18 ft. of surface soil was shot down at a single blast, the drill-hole being plugged at the bottom and loaded with dynamite. The result of the blast was an opening more than large enough to accommodate an ordinary mine bucket, and in this bucket workmen were lowered and the sides trimmed. Mr. Correll con-

siders that it would have proved preferable to first sink from the surface down to the hard limestone, and then beginning the rise. As it was, an enormous mass of soil was shot into the drifts when the surface was blasted, and this became a sticky mass following a heavy rain. It was almost impossible to remove it, and as a result much valuable time was lost. The surface caved, also, to some extent, but heavy concrete walls were built down to the limestone, thus making it secure.

The rising method has many advantages over the former methods of shaft excavating employed in the district. Ordinarily in shaft-sinking the necessity of removing the pumps before each blast, or the necessity of at least covering them with heavy timbers, is of great importance. Repairs are constantly being made to the pumps as the result of damage from the shots. Water is invariably rising in the sump, and the workmen have an unsanitary place in which to toil. The cost of \$1273 does not include the cost of sinking the 6-in. drill-hole, which was already at hand. If it had been necessary to sink such a hole, the added cost would have been 80 cents per foot, including the casing, meaning a total of \$168 to be added to the figures already given. At all times the ventilation was good, as the fumes quickly lifted through the drill-hole.

New Method of Precipitation by Zinc.—The January number of the *Journal of the Chemical, Metallurgical, & Mining Society of South Africa*, contains papers read by John S. MacArthur and James Hutton, describing a new method of using zinc in the precipitation-boxes of cyanide plant. After reviewing the advantages and disadvantages of zinc shaving, Mr. MacArthur describes his method, which consists in using zinc sheet cut into wafers 1 to 2 in. long and $\frac{1}{4}$ to $\frac{1}{2}$ in. wide. In cutting them by a guillotine, the edges and corners are slightly distorted, so that when packed in the box the wafers do not touch, except the edges, so that channels of uniform width are left between them for the circulation of the gold solution. Zinc in this form was described by Lloyd and Rand in a paper read before the society in 1909, but it is used in a rotary extractor, revolving on a horizontal axis. Mr. MacArthur does not consider the motion advantageous, because it does not ensure a regular flow of the solution past the zinc surfaces. Mr. Hutton's paper contains an account of the practice of this process at the mine where it was introduced in 1907, namely, the Caveira in Portugal, 70 miles south of Lisbon, and on the belt of copper deposits stretching through the south of Portugal and Spain. The gold and silver are found in the ferruginous gossan, and the lower levels are worked for copper. The average content is $1\frac{1}{2}$ dwt. gold and 4 oz. silver per ton, but the figures varied over a wide range. The gold-silver ore is porous and soft. After passing a jaw-crusher, it goes to pans, fitted with $\frac{1}{4}$ in. screens, where it is dry-crushed. Thence it is delivered to treatment-vats, which measure 30 by 8 ft. and hold 200 to 230 metric tons. Cyanide solution containing 0.25% is introduced and allowed to remain for a few hours before draining. This is followed by a second solution, containing 0.12%, and subsequently by a water-wash. The average extraction is 80% of the gold and 75% of the silver. The zinc-boxes are 8 in. number, and of similar design to those used with shavings. The fall is 1 in 4, and the depth of each compartment is 8 in. The clippings are made from No. 12-gauge zinc sheet, and measure $\frac{1}{4}$ by $1\frac{1}{2}$ in. The cutting is done by an ordinary guillotine such as is used by printers, and the cost of the machine is not more than £10. About 55 lb. weight is packed into each compartment, filling it to

the depth of 3 in. The 10 compartments of each zinc-box therefore contain about a quarter of a ton of clippings. The rate of flow through the boxes is 70 to 80 tons of solution per 24 hours, which is rapid, being fully 10 tons of solution per cu. ft. of zinc per 24 hours. The assay value of the solution leaving the boxes is about $\frac{1}{2}$ dwt., practically the whole of it being silver. At the clean up the solution is decanted to within an inch or two of the zinc, the clippings scraped together, and washed in the same compartment by a simple process of sieving; they are then removed while the precipitate is washed out of the boxes. New zinc is added to the last compartments to compensate for loss by consumption. The precipitate, when it is washed out of the boxes, runs down the side launder, and is collected in a large iron collecting-vessel which runs on wheels and can be moved from box to box. On entering the collector, the solution passes through a 20-mesh screen, which catches any stray pieces of zinc. The precipitate is heavy and need not be filtered, it can be drained by simply scooping a cavity in the middle and bailing out the water that collects there. Acid treatment is not required, as the precipitate is rich and free from zinc. On an average it contains 35% metal fine, and often over 50%. The precipitate after draining is dried, but not calcined, and mixed with flux and smelted in crucibles. In this way bullion averaging 75 to 95% fine can be obtained. The consumption of cyanide is about 1 lb. per ton of ore; and of zinc 2.4 to 4.8 to 1 of fine metal recovered, or 8 to 16 oz. per ton of ore. All the work in the extractor house, cutting zinc, cleaning-up, and smelting, can be done by 2 men, assisted by the foreman. From this small plant $\frac{1}{2}$ of a metric ton of pure bullion has been recovered in one month. Mr. Hutton draws attention to the fact that no channelling occurs, as owing to the weight and slow consumption of the wafers, an even surface is assured mechanically without the aid of dressing. The ore is complex and contains small amounts of other metals. Selenium is found as a matte on the top of the bullion. Mercury also is present in sufficient quantities to warrant a retorting furnace being used for recovering it from the precipitate. At one time lead was present in sufficient quantity to make emulsion of the bullion necessary.

Multiple-Deck Slime-Table.—In our issue of September last we gave some particulars of the Willey multiple-deck slime-concentrator. A similar machine is made by the Deister company, of Fort Wayne, Indiana, and Henry S. Munroe gives a description of it in his review of concentration during 1912 in the *Mining and Scientific Press* for January 11. The Deister multiple-deck tilting slime-table has had eight months' trial at the Miami concentrator, and the results have proved sufficiently encouraging to warrant the equipment of one section of this mill with the new machines. Each machine contains six decks, each 10 ft. wide by 12 ft. long, covered with oiled and painted canvas, which is coated, while the paint is wet, with 50 to 60-mesh sand. These decks are pivoted at the centre on transverse axes, and are automatically tilted forward during the spreading of the slime, and backward while washing off the concentrate. The capacity of a six-deck machine is about equal to that of four standard Deister slime-tables. The tailing from the new machines contains little of value, and the saving is approximately 10% as compared with the ordinary slime-tables. The concentrate is re-treated on a Deister slime-table, the tailing from which goes back to the tilting tables. Presumably the pulp does not pass over each deck in succession, but this point is not made clear in Mr. Munroe's description.

CURRENT LITERATURE.

Reinforced Concrete in Mining.—The volume of *Transactions of the Lake Superior Mining Institute* for 1912 contains a paper by H. T. Mercer on applications of reinforced concrete underground, relating chiefly to sets made of this material. The volume also contains a paper by S. R. Elliott on the new circular shaft at Negaunee iron mine, Michigan. This shaft was first cut as a rise from the 800 ft. level, in one lift, and subsequently lined with concrete.

Humphrey's Pump.—In our issue of January 1910, we gave particulars of the new system of pumping invented by H. A. Humphrey, whereby gas explosions are used for raising the water in direct contact with the gaseous mixture. *Engineering* for February 14 contains a detailed description with full working drawings of the pumping plant erected at the Chingford reservoirs belonging to the London Water Board.

South American Mining.—In the *Mining and Scientific Press* for January 25, Howland Bancroft reviews the present conditions of mining on the west coast of South America.

Goldfield Consolidated.—In the *Mining and Scientific Press* for January 25 and February 1, J. W. Hutchinson gives additional details relating to the cyanidation of concentrate at the Goldfield Consolidated plant in Nevada.

Copper Queen.—At the February meeting of the Institution of Mining and Metallurgy, a series of papers was presented on the Copper Queen mine and smelter, Arizona, by James Douglas, Arthur Notman, Charles Le Grand, and George B. Lee.

Bogoslowsk.—At the February meeting of the Institution of Mining and Metallurgy, Richard Davey presented a paper describing the copper smelter at Bogoslowsk, Perm, Russia.

Copper Assay.—In the *Engineering and Mining Journal* for February 1, P. S. Harrison, of Aguascalientes, Mexico, chemist to the American Smelting & Refining Co., gives details of experiments on mattes containing much arsenic, antimony, and other impurities, with a view of testing the relative advantages of the electrolytic and iodide methods of assay for copper content. His results were in favour of the iodide method.

Bismuth.—The *Bulletin of the Imperial Institute* for December contains an article on the occurrence, distribution, and utilization of bismuth ores.

Outcrops.—In the *Engineering and Mining Journal* for February 15, Morris J. Elsing presents a study of the relation of the outcrop to the ore deposit at the Cananea copper mine, Mexico.

Origin of Sulphur Deposits.—*Economic Geology* for December contains a translation, by W. C. Phalen, of the chapter on sulphur in O. Stutzer's book, published in Germany. This article gives the theories of the origin of deposits of native sulphur in recent sedimentary rocks, and elaborates the theory of bacteriological action in releasing sulphuretted hydrogen from organic compounds.

Gold Placers in China.—In the *Mining and Scientific Press* for February 15, E. C. Thurston describes the gold placers in Central China, in the Hupeh and Hunan provinces. He gives details of the nature of the deposits and of the gold contained in them, together with the native methods of exploiting them.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

BOOKS REVIEWED

Mining Engineers' Examination and Report Book.—

By Charles Janin. Leather, octavo, 150 pages, with diagrams and illustrations. San Francisco: *Mining and Scientific Press*; London: *The Mining Magazine*. Price 10s. 6d. . skeleton form only 2s 6d.

Some years ago Bernard Macdonald published a skeleton form of report for mining engineers, and this proved highly popular in America. Unfortunately it was allowed to run out of print before its usefulness was fully appreciated in other countries. Books on similar lines have been issued in this country by A. G. Charleton and by E. R. Field. Engineers are never without a copy of one or other of these books, for they serve the admirable purpose of refreshing the memory with regard to the thousand and one details which together go to form the economic problem of profitable exploitation of an ore deposit. Mr Janin's book will also be acceptable. He comes of a family noted for shrewd observation in connection with mining. The form in which his book appears is different from that of its predecessors, in that the skeleton report is packed in an end pocket, and can be renewed at 2s. 6d. for each mine examination. The main body of the book contains instructions and suggestions as to the methods of examination and reporting, together with a vast amount of useful statistical and general information, such as the cost of operation, the capacity of various types of plant and processes, the weight and cost of plant, etc. In fact the book is as valuable as a pocket reference-book as it is a report book.

E. W.

Building Stones and Clay Products. By Heinrich

Ries. Cloth, octavo, 420 pages, illustrated. New York: John Wiley & Sons; London: Chapman & Hall. Price 12s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

About a year ago we recorded the publication in England of a book on building stones written by a geologist of note, G. Allen Howe, and expressed our appreciation of this type of work, which links scientific geology to engineering practice in its various branches. We now have similar pleasure in welcoming an American book covering very much the same ground, though drawing its examples from the home industry. Mr. Ries is not only, however, an expert geologist, his writings on economic geology being well known, but he is also one of the leading living authorities on clays and their applications. Thus his book covers, in addition to natural stones, the clay products, bricks, terra-cotta, tiles, and all classes of earthenware used for building purposes. The book is not intended in any way as a rival of G. P. Merrill's encyclopedic work on 'Stones for Building and Decoration'; it is more in the nature of a general guide for the use of architects. As such it will be welcomed by a large circle of readers.

Iron Making in Alabama. By W. B. Phillips. Cloth, octavo, 254 pages, illustrated. Montgomery, Alabama: The Geological Survey of Alabama.

This is the third edition of W. B. Phillips' work, describing the iron-ore deposits and the practice of iron-smelting, steel manufacture, and coke making in Alabama, a work which enjoyed a high reputation. The new edition was ready for press in 1908, but as the State Government did not provide funds, its printing was delayed. In the meantime, Mr. Phillips left

the Alabama Survey, and in order to bring the book up to date, the services of other engineers were requisitioned.

Index to the Stratigraphy of North America. By Bailey Willis. Quarto, paper covers, 900 pages, with maps. Washington: Government Printing Office.

This is Professional Paper No. 71 of the United States Geological Survey, and it has been compiled in co-operation with the Canadian and Mexican Geological Surveys. The work consists essentially of the series of geological maps of the North American continent, and the book is a summary of the authorities and records from which they have been prepared.

The Principles of Applied Electro-Chemistry. By A. J. Allmand. Cloth, octavo, 560 pages, illustrated. London: Edward Arnold. Price 18s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The author has continued the work of his teacher, Professor F. Haber, who, in 1898, published a book in the German language on the elements of electro-chemistry, by publishing a similar book in English, with the information brought up to date. He is also indebted to Professor F. Foerster who wrote a book, also in German, on the electrolysis of solutions. A large amount of additional matter comes from the German and American papers and transactions. The book is strictly scientific, and as such is helpful to the metallurgist who is desirous of becoming acquainted with the modern explanations of chemical reactions based on electrolytic theories. The author also shows his personal acquaintance with many commercial branches of the subject; but it cannot be said that metallurgy is one of his strong points. His account of the metallurgy of gold seems to be based on Rand practice of twenty years ago.

Mixed Metals, or Metallic Alloys. By Arthur H. Horns. Small octavo, 470 pages. London: Macmillan & Co. Price 6s. For sale at the Technical Bookshop of *The Mining Magazine*.

We are glad to receive a third edition of this useful handbook. The work originally appeared in 1890, and much has been discovered since then, both in the theory of alloys, and in new mixtures and applications. The author is teacher in the Birmingham Technical School, situated in the very heart of the mixed-metal trades, and naturally, therefore, he writes with experience and authority.

Refractories and Furnaces. By F. T. Havard. Cloth, octavo, 360 pages, illustrated. New York: McGraw-Hill Book Co. Price 17s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

Mr. Havard is associate professor of metallurgy in the University of Wisconsin, and has had experience at copper smelters in various parts of the world. The sub-title of the book, 'Properties, preparation, and application of materials used in the construction and operation of furnaces,' describes its scope and object.

Handbook of Mining Details. Cloth, octavo, 380 pages, illustrated. New York: McGraw-Hill Book Co. Price 17s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The *Engineering and Mining Journal* has a weekly column, entitled 'Details of Practical Mining,' and this book consists of a reprint of 'Details' most worth preserving, that have appeared from August 1909 to July 1912.

Mines and Their Story. By J. Bernard Mannix. Cloth, octavo, 336 pages, with many illustrations. London: Sidgwick & Jackson. Price 16s. net.

This is one of a series of popular books, containing in their title such words as "and their story," "the glory of—" and "the grandeur that was—." We do not know Mr. Mannix, or whether he is a mining man, a journalist, or a professional author. It would have helped the lay reader greatly if the publisher had given the author's credentials. Two-thirds of the book deals with gold, diamonds, and silver, and the remainder with coal and iron. No doubt the book will serve its purpose in proving the inherent dignity of mining to the thoughtless populace, but the details are not sufficiently accurate to arouse the confidence of the serious student of mining.

Year Book of Scientific and Learned Societies of Great Britain and Ireland. Cloth, octavo, 380 pages. London: Charles Griffin & Co. Price 7s. 6d. For sale at the Technical Bookshop of *The Mining Magazine*.

The vast ramifications of technical societies are difficult to follow, and even the serious student is often at a loss to trace the origin of erudite and valuable contributions to scientific knowledge, presented to such societies, or for that matter to the weekly and monthly press. For example, we doubt if many of our readers could give a list of the various societies in this country devoted to geology and mining, and probably none could accurately quote the name of the respective secretaries and their domiciles. Griffins perform a genuine service to the searcher for information in this direction. The volume is divided into fourteen sections dealing with the several groups of subjects, such as engineering, mining, chemistry, geology, medicine, archeology, photography, economics, law, literature, etc. We hate to utter a jarring word when commending so useful a book, but nevertheless the personal element rebels against the following entry relating to a paper presented to the Institution of Mining and Metallurgy: "Ricard, T. A.—Domes of Novia Scotia." We hope that the publishers will, at some future date, make an attempt to extend the scope of this volume, and include a record of the chief American, Continental, and Colonial societies, though no one is better aware than ourselves of the inherent difficulties of such a task. E. W.

The Mining Manual and Mining Year Book, 1913.

By Walter R. Skinner. Cloth, octavo, 1360 pages, with maps and plans. London: W. R. Skinner, and *The Financial Times*. Price 15s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The value of the service done by Mr. W. R. Skinner, during the last 26 years, to the mining and investing communities is incalculable. During this period he has issued a yearly volume containing information about all the mining companies registered or doing business in this country. He and his staff have always been remarkably correct in details, and in this way have won the confidence of readers and consultants of their pages. A few years ago *The Financial Times*, a paper which all ways combines good temper, accurate knowledge, and honourable purpose, started the 'Mining Year Book.' At the time we expressed a doubt whether the book was really needed, for the information and its arrangement did not materially differ from that of Skinner. However, as it appeared at a six-monthly interval after its rival, the service given to the public was of material value, for a reference book of this

sort becomes out-of-date rapidly and the oftener one is published the better it is for the searcher. Subsequently the dates of publication were altered in such a way that the two books made their appearance practically simultaneously. The futility of this duplication of work became obvious to the respective publishers as well as to the purchasers, and by a wise policy characteristic of the two firms an amalgamation has been effected. The new volume follows Mr. Skinner's system, and the only variation we note is the absorption of 'Australasian' into 'Miscellaneous.' Seeing that Australasia occupies a minor part of the attention of English investors and speculators, this alteration is logical. The book is now divided into 'African' and 'Miscellaneous,' the former including the Transvaal, Rhodesia, the Gold Coast, and Nigeria, and the latter Australasia, North and South America, Asia, and Europe. It is hardly necessary to add that we wish everlasting prosperity to this valuable publication. E. W.

Mines of Africa. By K. R. Mabson. Cloth, octavo, 800 pages, with maps and plans. London: *The Statist*. Price 21s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This yearbook, published by *The Statist*, originally dealt with the Transvaal mines only. Subsequently the scope of operations was extended to Rhodesia, the Gold Coast, and Nigeria. The information given is similar to that in Skinner, and in addition, statistics are included relating to the cost of operations and reserves of ore.

South African Mining Directory and Monthly Handbook. Paper covers, octavo, 200 pages. Johannesburg: *South African Mining Journal*. Price 7s. 6d. monthly or £2. 10s. yearly.

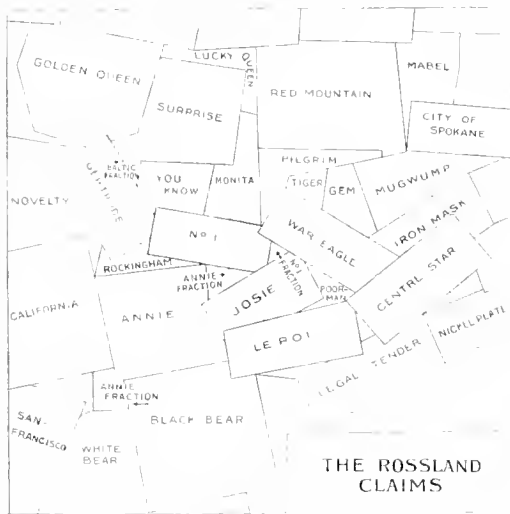
This is a directory of the officials at all the mines in South Africa. It gives the names, addresses, and telephone numbers of the individual members of the staffs, from the directors and managers, down to the storekeepers and time-keepers. It has been compiled for the special benefit of those who have something to sell, but it will be vastly useful in many other ways. The fact that it is to be published monthly is in itself a commentary on the continual changes in the staffs, so characteristic of South Africa.

Dictionary of Secretarial Law and Practice. Edited by Philip Tovey. Half-leather, quarto, 760 pages. London: Sir Isaac Pitman & Sons. Price 25s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

In a recent issue we made short reference to the appearance of this book, which was published in serial form. The book has now been completed and is sold in one volume. While intended primarily for the guidance of secretaries of companies, it is of equal value to shareholders and directors, and in fact to everybody having an interest in business and financial operations. It is an alphabetical analysis of company law and business practice, an arrangement which helps even the merest tyro in ascertaining the law and practice in connection with every detail of administration. We expect to find it popular among mining engineers. The editor is well known as an author, and his writings explaining balance-sheets, prospectuses, etc., have been helpful. He has been assisted in the preparation of this work by a host of specialists, prominent among whom are F. Gore-Browne and F. W. Pixley. We have examined the book closely, and have already found it most useful, for it clearly and tersely answers any question of company practice that may happen to be placed before us.

COMPANY REPORTS

Le Roi No. 2.—As we have previously recorded in these columns, this company was one of the Whitaker Wright promotions, and subsequently has been managed by Alexander Hill & Stewart. The capital, £600,000, was far too high for the character of the property, and the profits earned by the present management, though really satisfactory in themselves, look small when the capitalization is mentioned. The report for the year ended September 30 shows that 40,112 tons of ore was raised. Of this, 18,257 tons was sold direct to the smelters, averaging 15½ dwt. gold, ¾ oz. silver, and 1.39% copper. This was 9000 tons less than the year before. In addition, 17,116 tons of low-grade ore was concentrated, averaging 2¼ dwt. gold and 0.5% copper, yielding 1658 tons of concentrate averaging 22 dwt. gold, ¾ oz. silver, and 1.14% copper. The profit and loss account shows an income of £60,820, and a net profit of £3043. A dividend of



£6000, or 1s. per £5 share, was paid in July last, out of £30,481 balance brought forward from the previous year. The development work during the year has been impeded by the dispute with the Consolidated Mining & Smelting Company of Canada, the owner of the War Eagle and Centre Star, and since 1911 of the property of the Le Roi company. The new owners made claims based on extralateral-right laws, under which the claims were originally staked. Fortunately the two companies have compromised instead of going to law. By the arrangement, Le Roi No. 2 takes the Monita claim, and parts of the Josie and No. 1 properties go to the Consolidated company. Since this matter was settled, it has been possible to inaugurate an extensive scheme of development in the country north of the Josie. It is hoped to find the extension of the rich shoot of the War Eagle. An ore-shoot has been found at 1500 ft. and a drift has been run from the 1650-ft. level of the Le Roi mine, by permission of the Consolidated company, for the purpose of developing it. The company owns a large share in its subsidiary, the Van-Roi Co., particulars of which are given in the next paragraph.

Van-Roi.—This company was formed in 1908, as a subsidiary of the Le Roi No. 2, for the purpose of acquiring the Vancouver group of silver-lead-zinc pro-

erties in the Slocan district of British Columbia. The capital is £34,500, divided into 30,000 preference shares of £1 each, and 90,000 ordinary shares of 1s. each. The purchase price was £20,000 cash paid to the local owners, and 60,000 ordinary shares paid to the Le Roi No. 2. At first, the ore was concentrated in the Wakefield mill, which was leased for the purpose. Subsequently a mill was built by the company and it started operations in March 1911. The report for the year ended September 30 last shows that 54,115 tons of ore was raised, averaging 15 oz. silver, 3¾% lead, and 6¼% zinc. The yield by concentration was 2392 tons of lead concentrate, assaying 179 oz. silver, 60% lead, and 11% zinc; and 2570 tons of zinc concentrate, assaying 60 oz. silver, 3.7% lead, and 45% zinc. A large amount of development work has been done, and at several points ore-shoots of high grade have been disclosed. Owing to the fluctuations in the content of the veins, the monthly returns are variable, nor is it not possible to make an estimate of the reserve. Now that development has overtaken stoping, the conditions in future will be more regular. The profit and loss account shows an income of £71,217 from the sale of concentrate, and a net profit of £26,742. Out of this profit, £20,000 was allocated to the fund for payment for the mill.

Arizona Copper.—We have on many occasions reviewed the history of this company, which was formed in 1882 in Edinburgh to work the Longfellow and Metcalf groups of copper mines in the Clifton district, Arizona. In our issue of December 1911, we gave details of the reorganization of the smelting plant, devised by L. D. Ricketts on similar lines to that at Cananea, whereby it will be possible to treat the large reserves of low-grade ores in the mines. For the purpose of raising the funds required, £500,000 debentures were issued. The report for the year ended September 30, now issued, shows that the erection of the new smelting plant is in hand, as is also the extension of the concentrators. It is hoped that the new smelter will be ready toward the end of the coming summer, but the new concentrator will not be completed till later in 1913. During the year under review, the production of copper was 19,066 short tons, as compared with 17,292 tons the year before. The total amount of ore raised was 927,116 tons, as compared with 744,746 tons. Of this amount, 655,396 tons came from the Longfellow group, and 271,720 tons from the Metcalf group. The sale of copper and bluestone brought an income of £1,184,051, and the revenue from holdings in railway companies was £72,828. The cost was £753,076. Out of the profit, £170,000 was placed to reserve for capital expenditure, £23,332 was paid as interest on debentures, £24,531 as dividend on preference shares, and £246,983 as dividend on the ordinary shares, being 3s. 3d. on each of the 1,519,896 shares of 5s. each, or at the rate of 65 per cent.

South Kalgurli Gold Mines.—This company was formed in 1895 to acquire the Gaelic claims at Kalgoorlie, West Australia, situated between the property of the Kalgurli, Hainault, and Perseverance companies. Milling started in 1900, but was suspended between 1903 and 1905, while a new metallurgical plant was erected on the principle of dry-crushing, roasting, and cyaniding. Dividends have been paid since 1905. The report for the year ended September 30 shows that 112,262 tons of ore was raised and treated, yielding 33,250 oz. gold, worth £140,964. After all expenses were paid and allowance made for depreciation, £16,426 was available for distribution, and the dividends absorbed £15,000, being at the rate of 7½%.

The extraction per ton was 25s. 1d., the mining and treatment cost 17s. 11d., and the development cost 2s. 10d. John Morgan, the manager, reports that 4211 ft. of development was done, and that at the end of the period the ore reserve was 174,097 tons, averaging 5.73 cwt., together with 78,385 tons 'probable,' averaging 5.3 dwt. The figures for tonnage are nearly the same as at the beginning of the year, but the estimated content of both 'proved' and 'probable' ore is $\frac{1}{2}$ dwt. lower. The latest work on the 1800-ft. level points to an increase in the grade. An agreement has been made for the amalgamation of this company with the adjoining Hamault. A new company is to be formed with a capital of £150,000 in 10s. shares. The South Kalgurli will take 200,000 fully paid shares, of which 50,000 will be subscribed in cash as extra working capital, while the Hamault will receive 50,000 shares and £2000 in cash as consideration for the property. The remaining 50,000 shares will be held in reserve. The Hamault has made little or no profit during the last four years.

Mount Morgan Gold Mining.—As we recorded in our issues of August and September last, this celebrated Queensland gold-copper company has recently passed through a mild crisis owing to the miscalculations on the part of the former management with regard to the duty of the blast-furnaces, especially after the Many Peaks pyritic flux was substituted for the barren ironstone previously used. The advice of the

Material	Tons	Copper Obtained. Tons.	Copper %	Gold Obtained. Oz.	Gold per Ton. Dwt.
Mount Morgan Copper Ore.....	93,782.95	3,276.54	3.49	42,744.49	9.11
.. .. Gold Ore.....	19,895.39	529.71	2.66	18,831.38	18.93
Many Peaks Ore	54,394.00	893.52	1.64	413.36	0.15
Purchased Ore	178.43	22.56	12.64	9.19	1.03
Miscellaneous Products.....	4,172.79	282.12	6.76	554.75	2.66
TOTAL	172,423.56	5004.45	2.90	62,553.17	7.25

In addition to this there were used 34,363 tons of limestone and 20,702 tons of coke.

Mount Lyell metallurgists was sought, and as a result the old chlorination plant was abolished, and the whole of the Mount Morgan ore now goes to the copper-furnaces. G. A. Richard resigned the position as general manager, and he has been succeeded by Benjamin Magnus, formerly metallurgist to the Electrolytic Smelting & Refining Works of Port Kembla, New South Wales, where the Mount Morgan blister copper is treated. The half-yearly report for the period ended November 30 last shows that the smelters have treated the amounts of ore as indicated in the above table. The clean-up at the old chlorination plant yielded 7089 oz. gold. The silicious gold ore formerly treated in that plant now goes to the smelter, and it naturally requires more flux than the pyritic ore, so that the cost of producing copper in the furnace is slightly increased. As against this, the percentage recovery of the gold is greatly increased by the new method of treatment. Much money has been spent in improving the present plant, and designs are in preparation for the erection of an entirely new smelter. The reserve on November 30 was calculated at 1,433,000 tons of high-grade and 1,997,000 tons of medium-grade ore. The average content is not given, but presumably the figures are as published in the previous report, namely, $3\frac{1}{2}$ % copper and 10 dwt. gold, and $2\frac{1}{2}$ % copper and 5 dwt. gold respectively. Exploration by diamond-drilling has been commenced. Developments at the 1050-ft. or lowest level are encouraging. The accounts for the 6 months show receipts of £30,016 from the

sale of gold produced in the chlorination plant, and £600,452 from the sale of blister copper. The cost was £387,585, dividends amounted to £100,000, being 2s. per £1 share, £44,706 has been allowed for depreciation and replacement of stores, and £100,000 has been allocated to the fund for rebuilding the smelter.

Dolcoath.—The report of the premier tin mine of Cornwall for the six months ended December 31 shows that a larger amount of ore was raised than ever previously recorded, while the total income, the profit, and the price per ton of concentrate also provided records. On the other hand, the yield per ton is the lowest since the mine was acquired by the present limited liability company in 1895, the figure being 32 lb. black tin, as compared with 36 $\frac{3}{4}$ lb., 41 $\frac{1}{4}$ lb., and 47 $\frac{1}{4}$ lb. during the immediately preceding half years, and 79 lb. in 1895. In the last mentioned period, the average price of black tin was only £39 per ton, as compared with £137 10s. during the period now under review. The amount of black tin sold was 868 tons, and the income £118,481. The receipts per ton of ore were 39s. 1d. The working cost was £63,946, or 21s. 1d. per ton, the lord's royalty £7,965, or 2s. 7d. per ton, the total cost £71,912 or 23s. 8d., and the working profit £46,569 or 15s. 4d. per ton. The decrease in cost per ton is notable, being 4s. 2d. less than during the previous six months. The decrease is explained by the greater efficiency of the new hoisting

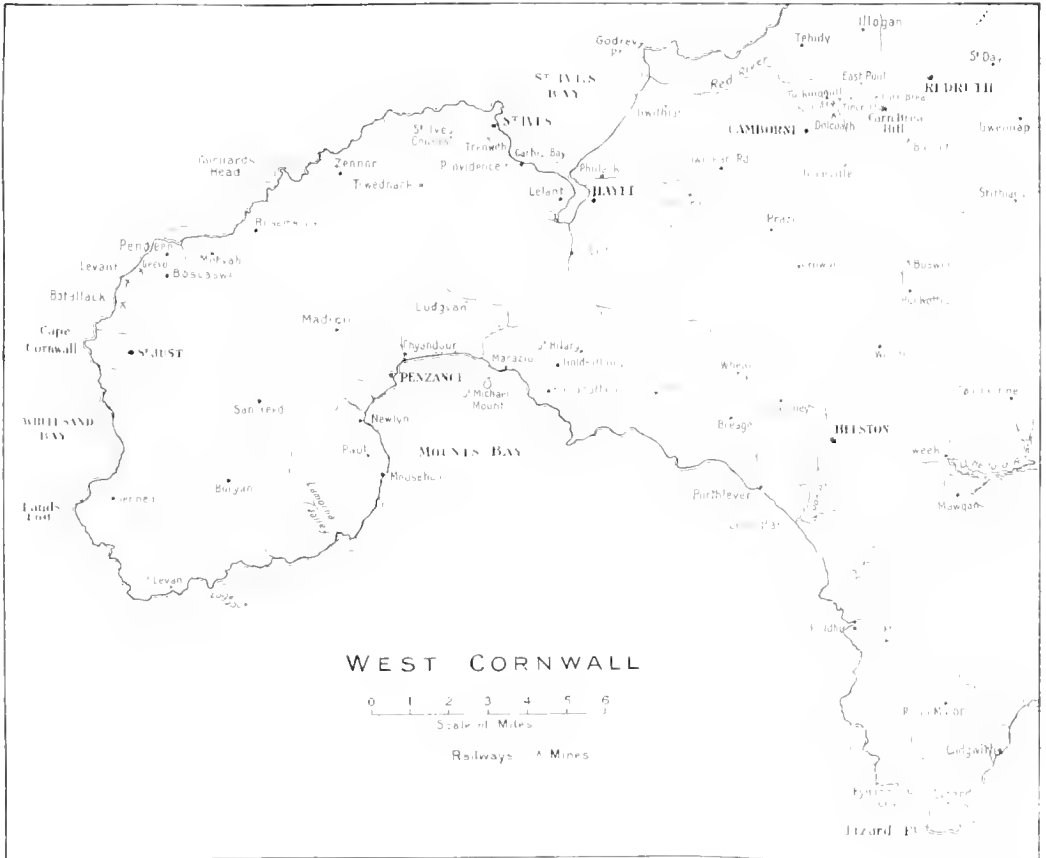
and dressing plant, and the increase in the tonnage raised and treated. Out of the working profit, £4786 has been allowed for depreciation, and £43,750 has been distributed in dividends, being at the rate of 2s. 6d. per £1 share. The recent developments and future prospects of the mine are described in the report of the manager, R. Arthur Thomas. He shows that ore discovered in the deep levels around the new vertical shaft is of comparatively low grade. Though patches of ore containing as much as 60 lb. black tin per ton have been found, the average is much less, and many stretches are of doubtful profitability. The lowest, or 3300-ft., level is in poor ground. The new air-compressor is at work, and exploration and development will be henceforth conducted on a more extensive scale.

Grenville United Mines.—This company was formed in 1906 under the limited liability laws, to acquire the mines of that name situated to the south of Camborne, Cornwall, that had previously been worked on the cost-book system. Much active development has been done since then, and the continued increase in the output is gratifying. The report for the second half of 1912 shows that 22,066 tons of ore, was raised, and that 386 tons of concentrate was recovered, equivalent to 39 lb. per ton. The figures for the previous half-year were: 19,306 tons of ore, 331 tons of concentrate, and 38 lb. per ton. The income from the sale of concentrate was £54,129, as compared with £47,012, and the divisible profit was £18,662, as com-

pared with £13,789. The dividend absorbed £16,000 on a paid-up capital of £84,058. The sinking of the main shaft to the 2250-ft. level is nearly completed, and it will be possible within a short time to commence driving east and west at this level. Henry Batters, the manager, is of opinion that developments on this level will prove of considerable importance. The developments on the 2130-ft. level are also highly encouraging. A new air-compressor has been ordered, and it is to be operated electrically. The water question still gives rise to anxiety, and the speed of the Cornish pumps has been increased.

Carn Brea & Tincroft.—In previous issues we have given the history of this Cornish tin-mining company, and have recorded how, nearly two years ago, Edward

ten years ago. The recovery was 455 tons of tin concentrate, as compared with 568 tons, the highest on record, which was obtained from 36,825 tons of ore during the half-year ended June 1909. The yield per ton was 21'22 lb. black tin, the lowest on record, and comparing with 34'35 lb. during the other period quoted. The price obtained per ton was £125, the highest on record, as compared with £69. The total receipts were £57,078, also a record. The sale of wolfram and arsenic provided an additional income of £1670, and other items brought the total income to £59,900. The working cost was £50,994, and lords' royalties £2169, leaving a net profit of £6736. The receipts per ton were 24s. 11d., the working cost 21s. 2½d., and the total cost, including royalties,



S. King, on his appointment to the management, started on a campaign of vigorous development and of economical administration. He has been able to spend comparatively large amounts of money out of revenue for the purpose of improvements, developments, and repairs, without increasing the working cost per ton. Luck has not been kind to him in the way of discoveries of good quality ore, and as a matter of fact the content of the ore mined has been lower during the last two years than during any of the years since 1900, the date of the formation of the present company. On the other hand he has to thank the high price of tin for coming to his rescue. The report for the second half of 1912 shows that 48,055 tons of ore was raised, the highest on record, and about double of the figure

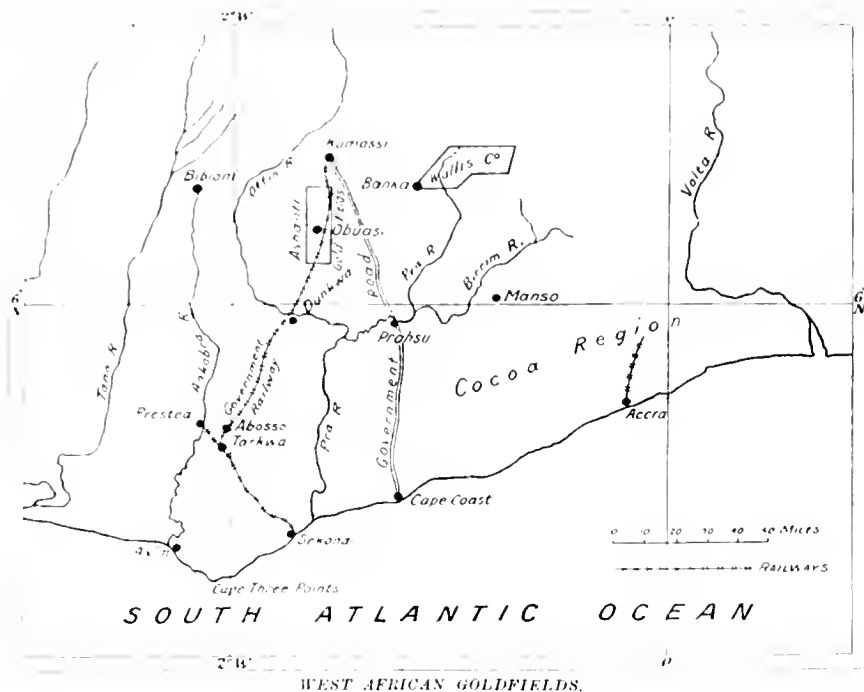
22s 1½d., leaving a profit of 2s. 9½d. A dividend at the rate of 5% was paid on the £50,000 priority shares in October last. Mr. King reports that according to the chemical assay, the recovery of tin is 67.6% of the content.

South Crofty.—This company was formed by the Allen-Meyerstein group in 1906 for the purpose of acquiring the mine of that name in Cornwall, adjoining the Dolcoath on the east. Josiah Paull is manager. The report for the year 1912 shows that 66,076 tons of ore was raised and treated, yielding 627 tons of black tin, 130 tons of wolfram concentrate, and 986 tons of arsenic compounds. The receipts from the sale of these products were £82,481, £11,147, and £9886 respectively. The yield per ton was 21'28 lb. black tin,

4.42 lb wolfram, and 33.45 lb arsenic compounds, and the receipts per ton were 24s. 11d., 3s. 3d., and 3s. respectively, or a total yield per ton of 31s. 3d. The production shows a decrease all round as compared with 1911, when 63,882 tons of ore yielded 677 tons of tin concentrate, 148 tons of wolfram concentrate, and 1008 tons of arsenic compounds. The income per ton in 1911 was 31s. 6d. The working cost per ton in 1912 was 22s. 6d., as compared with 20s. 2d. in 1911. The total income during 1912 from the sale of produce was £103,071, and the net profit was £25,201. Out of this, £20,000 has been distributed as dividend, being at the rate of 40% on the nominal capital, though it must be remembered that the bulk of shareholders who subscribed in cash paid £4 for

and that he has advised, instead, the exploitation of parts of the banks of the present rivers, which he has proved to be profitable. During the year under review, 3 dredges have been at work, and recovered gold worth £23,532. The cost of operations was £15,869, and £3,299 was allowed for depreciation of plant; £1053 was spent at the London office, and £1686 was paid as debenture interest. The balance of profit was £917. No dividend has yet been paid.

British South Africa Company.—In writing a year ago of this company, we recorded that for the first time a substantial profit had been made. The report for the year ended March 31, 1912, now issued, shows a continuation of this prosperity, though owing chiefly to the conversion of interest-bearing loans to the rail-



each £1 share. The sum of £5000 has been transferred to reserve, which now stands at £25,000. The directors have invested £6,839 of this reserve fund in bonds of the Chinese Engineering & Mining Co. and in bonds of the Cuba Railroad Co., but they have refrained from any further investment of such funds until a resolution has been passed by shareholders enabling them to invest in any security they may select. At the meeting of shareholders a resolution was passed confining the investment of the reserve fund to bankers' deposit.

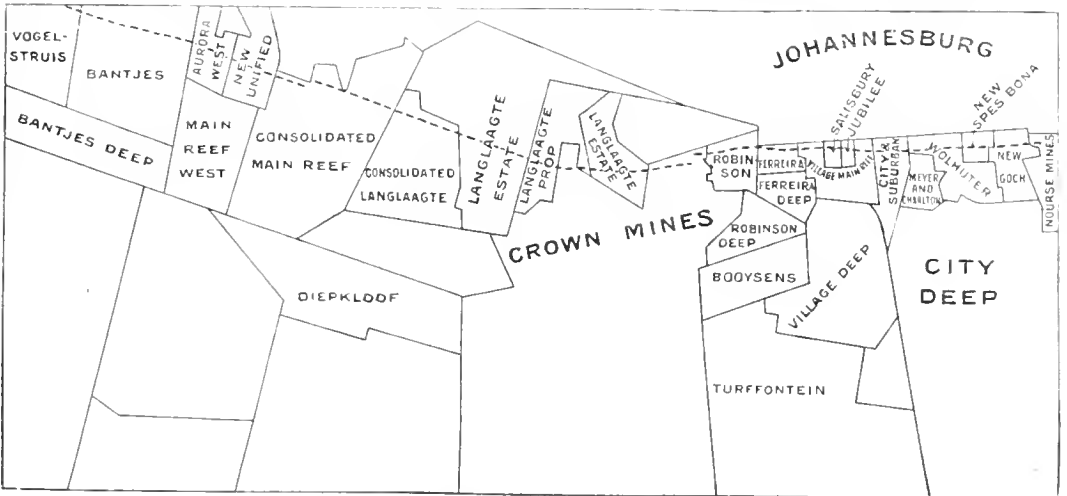
Ancobra Exploration & Dredging.—This company was formed in the summer of 1909 to acquire, from the Taquah Mining & Exploration Co. and the African Gold Dredging & Mining Concession, the rights of dredging on the Ancobra river from Prestea to the sea, a distance of 70 miles, together with certain rights on the banks and in the neighbouring country. S. J. Weis made an investigation two years ago and recommended that the old river bed should be tried instead of its present course, and he engaged R. H. Elliott to conduct a series of borings. The report of the company now issued, covering the year ended June 30 last, shows that Mr. Elliott's results were unfavourable,

way companies into shares in the Rhodesia Railways Trust, the credit balance is £69,000 less than the previous year, the exact figure being £101,569. The accounts show administrative expenditure in Southern Rhodesia £737,948, and in Northern Rhodesia £164,542, and public income £817,354 and £116,921 respectively. The commercial expenditure in Rhodesia was £67,639, and the income £189,315. London expenses were £43,351, the debenture interest was £63,552, and £11,430 was placed to reserve for bad debts. An income of £66,493 was received as interest on loans and investments. The net surplus was, as above recorded, £101,619. The total number of shares issued is 8,937,559, of £1 each, and there are £1,269,415 debentures. The feature of the policy of the company nowadays is the encouragement of agriculture in all its branches.

Wolhuter.—This company was formed in 1887 to acquire claims in the central part of the Rand. Many re-arrangements of the property and of deep levels connected therewith have been made, and for a long time the career of the mine was chequered. In fact, the payment of substantial dividends only commenced in 1910, though some were paid in 1894-8. The con-

trol is with the Neumann group, S. C. Thomson is consulting engineer, and A. R. Robertson was for ten years until last month the manager. To the last named is due much of the credit for the improvement in the position of the company. Milling was originally commenced in 1888, and a new battery was built in 1895. This plant was destroyed by fire in 1905 and was replaced by another in the following year, containing 120 stamps and 2 tube-mills. In 1911, an additional 2 tube-mills were provided. The report for the year ended October 31 last shows that the increase in the ore treated and the yield, recorded a year ago, has been maintained. The ore raised was 396,895 tons, and after the removal of 12½% waste, 347,300 tons went to the mill, an increase of 3035 tons over the previous year. The yield by amalgamation was 78,065 oz., and by cyanide 36,872 oz., being a total of 114,937 oz., worth £480,993, as compared with 109,235 oz., worth £456,965. The dividends distributed absorbed £150,500

Hebbard, the manager, "both Main and South Reefs have a much better appearance as well as values." During 1912, the 200 stamps and 5 tube-mills treated 635,353 tons of ore. The yield of gold by amalgamation was 69,522 oz., and the cyanide plant extracted 104,648 oz., of which 15,279 oz. came from accumulated slime. The revenue from the sale of gold was £733,212, and the working cost was £365,167, leaving a working profit of £168,045. Out of this profit, £11,867 was paid as taxes, £7676 for other rates, taxes, fees, etc., £6038 represented contributions under the Miners' Phthisis Act, £23,833 was appropriated for development and equipment, £1571 is entered as sundries, and £49 as depreciation of live stock and furniture. The shareholders received £132,125, being at the rate of 15%. The ore reserve on December 31 was calculated at 654,132 tons on the Main Reef and 716,507 tons on the South Reef, a total of 1,370,639 tons, but the average content is not specified. Since



PART OF THE CENTRAL AND MIDDLE-WEST RAND.

or 17½%, as compared with £129,000 or 15%. The working cost per ton milled was 17s. 4d., as compared with 16s. 6d.; the yield per ton was 27s. 8d., as compared with 26s. 6d.; and the profit per ton was 10s. 4d., as compared with 10s. The ore reserve on October 31 was 832,977 tons, averaging 6.48 dwt., as compared with 808,780 tons averaging 6.45 dwt. The estimated life of the mine is approximately 9½ years. Owing to scarcity of labour, it has been found necessary to increase the compressor plant to provide power for 38 additional drills, but it is not advisable to substitute machine work for hand power in all of the stopes, owing to the faulted nature of the ground, and the consequent liability of the hanging-wall to fall.

Langlaagte Estate & Gold Mining.—This company was formed in 1889, by J. B. Robinson, to work an outcrop mine in the central part of the Rand, and for some years it was one of the leading producers. In 1909 the adjoining properties, Block B and Langlaagte Exploration, were absorbed. The original property is nearing exhaustion, and Block B will be the chief mainstay in future. A year ago we recorded that the development work in Block B was giving unsatisfactory results. It is gratifying therefore to find, from the report for the year ended December 31 last, that the prospects have improved, and that, to quote J. A.

the commencement of dividends in 1889, £2,675,705 has been distributed to the shareholders.

Randfontein Central.—This company has, since March 1911, been working the Robinson properties in the far west Rand. The report for the year 1912 shows that 2,823,916 tons of ore was raised, and after the rejection of 8% waste, 2,573,908 tons was sent to the stamps. Being a consolidation of many properties, the company owns several reduction plants. Of the total 3000 stamps erected, an average of 752 were at work during the year. In 1911, the average was 745. The reason that a greater number of stamps have not been in use during 1912 is that many stamps and some tube-mills have had to be overhauled and repaired. The yield by amalgamation was 376,588 oz., and by cyaniding 357,192 oz., a total of 733,780 oz., or 5.7 dwt. per ton milled. The total revenue was £3,085,711, or 23s. 11d. per ton milled, and the working cost was £2,199,312, or 17s. 1d. per ton, leaving a profit of £886,399, or 6s. 10d. per ton. Out of the profit, £180,000 was paid as debenture interest, and £239,427 was appropriated for development and equipment. Profits tax accounted for £73,188, and there was an adverse balance from the previous year of £85,053 that had to be expunged. The shareholders received £209,685 as dividend, being at the rate of 5%

on 24,123,000. The ore reserve is estimated at 7,600,000 tons, averaging 6.2 dwt. The directors state that the supply of labour during the year was sufficient to meet the requirements.

Exploration Company. The report of this company for the year 1912 shows a gross profit of £80,644, and, after the payment of administration and examination expenses, a net profit of £56,815, out of which £20,250 has been distributed as dividend, being at the rate of 7½%. The assets of the company consist of £202,216's indiv. investments, £273,984 cash and loans on short call, and £50,000 freehold office property. The investments in the subsidiaries, the Tombay, El Oro, and Suchi Timber, are practically the same as a year ago. In February 1912, the Buena Tierra company was floated to acquire a lead-silver property in Chihuahua, by the subsidiary, the Exploration Company of England and Mexico, and the Exploration Company received as a dividend on its shareholding in the subsidiary, 99,999 shares in the Buena Tierra. Owing to the revolutions in Mexico, the Chihuahua smelter, which treats the ores, was running intermittently, so that the output of the mine has been curtailed. On the other hand, the development was not interrupted. A dividend was paid by the Buena Tierra of 5% in December last.

Borax Consolidated.—This company was formed in 1892, as a consolidation of the leading borax interests throughout the world, by the controllers of the California deposits, L. H. de Friese, F. M. Smith, and R. C. Baker being the leading spirits. In addition to the San Bernardino deposits in California, the properties and works included in the consolidation are situated in England, France, Austria, Turkey in Asia, Chile, and Peru. The report for the year ended September 30 shows that the trading profit was £293,597, and that £32,313 was received as interest; the administration expenses were £32,515, and £62,557 was written off for depreciation and for expenses in connection with reorganization of capital. In May last £570,000 was subscribed by the issue of debentures, for the purpose of extending the business of the company. Interest has been paid on £1,697,846 debentures, some carrying 4½ and 5%, and dividends have been paid on £1,250,000 preference shares, some carrying 5½ and some 6%. The £900,000 deferred ordinary shares received a dividend at the rate of 13½ per cent.

Barramia Mining & Exploration.—This company was formed in 1909 by John Taylor & Sons, as a subsidiary of the Egypt & Sudan Mining Syndicate, for the purpose of acquiring a gold mine in Egypt between Edfu, near Assuan, on the Nile, and the Red Sea. The capital is £55,000, divided into 216,000 preference shares of 2s. 6d. each entitled to a non-cumulative dividend of 10 per cent, and 112,000 ordinary shares of 5s. each. The preference shares also take one half of the further profits every year. The mine was worked by the ancients, and the veins are narrow and occasionally rich. It has been decided to make the financial year of the company coincide with the calendar year, so the present report covers only six months, ended December 31 last. The report shows that 2300 tons of ore was raised and milled, yielding gold worth £10,275. The profit was £2880, out of which £1271 was paid as dividend on the preference shares less income tax, and £1457 was written off for depreciation, etc. F. J. Tregay, who recently succeeded A. J. Rickard as manager, reports that the developments continue to be satisfactory, though owing to the nature of the deposit, no estimate can be made of the reserve. Being in the desert region, the water-supply

is a source of anxiety, and at present it is impossible to work the mill to its full capacity. A well is being sunk at a spot 5 miles away, where the prospects of obtaining plenty of water are hopeful.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

The Oil Well Supply Co. have just issued an interesting booklet called 'Snapshots in Oildom,' containing many well-produced photographs of the oilfields of the world.

The Ridge Roasting Furnace & Engineering Co. have received orders for three roasting furnaces, to be used in treating tin ores, two for use in England and one for shipment abroad.

The Wilfley Mining Machinery Company's bulletin No. 69 is ready for distribution. It is devoted to the Hardinge Conical Mills. Two pages of typical mesh test cards afford interesting testimony of the capacities of these mills.

The Earle Gear and Machine Company's bulletin on Herringbone Gears (double helical gears) advocates the adoption of these instead of the common type of spur gears for smoothness of action, high speeds, wearing quality, and noiseless operation.

The Manhattan Drilling Company's catalogue on the Dobbins Core Drill contains a description of this drill, a compact powerful machine of the chilled-shot type. Drill, hoist, and engine are direct connected, and can be operated independently.

The Hardinge Conical Mill Co. announce that the Copper Range Consolidated Mining company have increased their order from 23 to 30 conical mills. They have also received an order for another sectionalized mill from the Olla de Oro Mining Co. in Bolivia.

The Cyanide Plant Supply Co. have published a third edition of their Ridgway Filter pamphlet. The present machine is called the 'Reciprocating Ridgway.' It is stated that it has gained in simplicity and capacity over previous designs, and that it is successfully treating kaolin, pug, and sand.

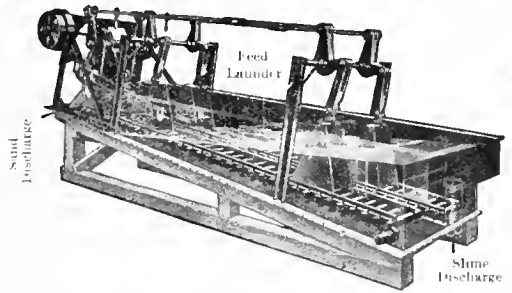
The Compayne (Hele-Shaw) system of power transmission by oil as applied to oil-well and general mining, is illustrated in a pamphlet issued by John Wells, of Cross Keys House, London, E.C. A rotary pump is made to carry the oil from the wells to the centre where power is to be generated.

Edgar Allen & Co. have sent us their latest catalogue G1. This gives a terse description of their many brands of special steel, made by the Crucible, Tropenas Converter, Siemens Open-Hearth, and Electrical Processes. The portions of the brochure devoted to miners' tool-steel and to manganese steel are of special interest to us. The applications of the latter to gold-dredges, and to the wearing surfaces of Crushers and Rolls, are varied and well known among mining engineers.

The Hayward Company, of New York, have just issued a magnificent catalogue relating to mechanical diggers of all sorts. Orange Peel buckets, Clam Shell buckets, Drag-Scraper buckets, etc.; also Cranes, Derricks, Telpherage systems, etc. The photographs vividly show the many applications. The power and strength of the orange-peel bucket is well illustrated by the photograph of a 1½ cu. yd. bucket raising a 20-ton boulder from a river. The drag-scraper bucket is particularly applicable for mining by steam-shovel, and if the rock is soft no blasting is required.

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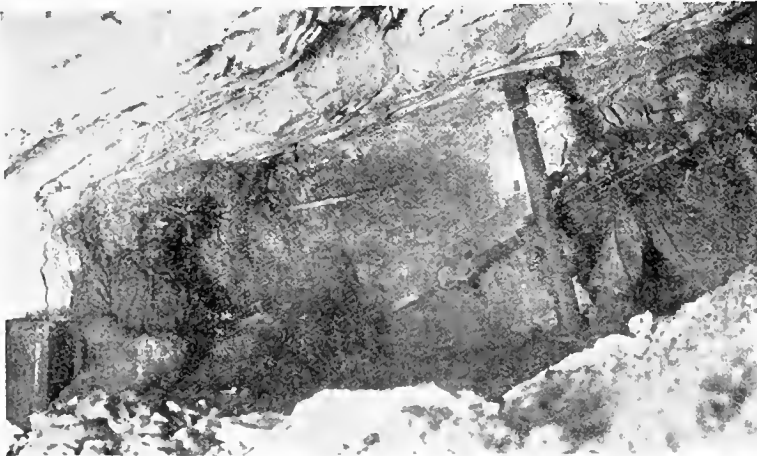
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The "Siskol" at work at the Crown Mines, Johannesburg
INTERNATIONAL CHANNELLING MACHINES Ltd., SHEFFIELD

CARN BREA AND TINCROFT MINES, LTD.

THE ordinary general meeting was held on February 27, at Tabbs Hotel, Redruth, Mr James Wickett (chairman) presiding.

The Chairman said they had treated a larger quantity of stuff than ever before, but there was no material alteration in the amount of profit. They had driven through a large quantity of ground that had not been very productive, but in Macdonald's part of the mine they were opening ground which in later time would develop into a very satisfactory affair. It was wonderful that in Cornwall for many years past they had not met with a real bunch of tin anywhere, but probably there was as good tin in the ground undiscovered as was ever taken away. He hoped they might be fortunate enough to meet with one of these bunches. At a Board meeting that morning the directors had declared a dividend of 1s. per share on the priority shares, and they hoped that in early course they may be in a position to declare another 1s.

Mr John Gilbert said that in order to raise the average grade of the ore, they must keep on developing. That was what their general manager, Mr King, and his lieutenant, Mr. MacDermott, were concentrating all the brains and energy upon. The other problem was how to make the best return from the tin when brought to surface. They were working with a worn-out and antiquated plant. The re-placement of much of this plant would have to be seriously considered.

He had submitted a plan to the Board for the provision of the necessary capital, and which they had agreed to adopt. He represented one of the mineral Lords, and he was authorized to offer on his behalf to provide the whole of the capital necessary to get the most approved mill and the best possible lay out that brains and money could provide for this mine. It would be a simple loan at a moderate rate of interest. This loan would be for such a protracted period, and on such terms in regard to repayment as might best suit the convenience of the Board and the management. They would not disturb any of the present batteries or works, but keep them going until the new plant was ready, and then stop the old plant one day and start with the new plant the next day. Thus there would be no interregnum when the mine would not be milling its usual quantity of ore. If in the meantime the mines could be developed so as to raise the grade of the ore, the future of the mine would be on a reasonable and satisfactory basis.

Mr I. S. King, the general manager, said that at North Tincroft, whence nearly half their tonnage had been mined, the general development had been highly satisfactory. Tye's shaft was now down the required distance to open up another level below the rich ground proved overhead for a length of 1500 ft. At South Tincroft the development work on Dunkin's lode was opening up an extensive orebody. Although of late it had been rather disappointing in contents, these were not too low to pay, and pay well, with an up-to-date plant, it tin held at anything like its present price. There were great possibilities in this section, and that same remark applied to the 335 Downright and 355 Cook's Kitchen levels. At Highburrow East they had been getting a small amount of rich ore by tributing. They were here in the neighbourhood of some most interesting unexplored ground where there might be

very considerable resources, and some intersections of the main series of orebodies where they might find the rich bunches Mr Wickett hoped for. In Macdonald's the development more than ever justified his previous conviction that here they had a mine in itself. Their present reserves amounted to 239,000 tons, or about three years' supply, of a value of 24 lb black tin per ton by vaning assay.

The report and accounts were unanimously adopted.

DOLCOATH MINE, LTD.

THE eighteenth annual general meeting was held on February 27, at Salisbury House, E.C., Mr. Frank Harvey, chairman, presiding.

The Chairman said they had the advantage of an increase of 14 16s. 4d. per ton on the price of tin sold over the previous six months, the average price being £137. 10s. 11d. Compared with the average price of £39. 6. 8d. realized in the first three and a half years of this company's existence to December 31, 1898, the advance was practically £100 per ton, a price scarcely dreamt of in those days. The quantity of lode stuff crushed showed a satisfactory increase of 12,065 tons, but the produce had fallen 4'64 lb per ton, owing to the fact that the high price permitted a lower grade of stuff to be profitably worked. The electrically-driven pumping plant continued to work satisfactorily. The royalty paid on tin sold now approximated to £16,000 per annum. It was satisfactory to be able to report such a large profit on the six months' working as £46,569, the highest made in any six months during the existence of the present company. The directors recommended the payment of a dividend of 1s. 6d. per share, which amounted, with previous payments, to a total distribution for the year of 20%.

Mr R. Arthur Thomas said he had no new features in the developments to report. In the Harriett section of the mine he had hopes that some exploration now in hand would give them comparatively large quantities of low-grade ore, which under the conditions obtaining could be worked at a margin of profit per ton. Until some discoveries were made in deeper levels in the ground underneath Stray Park and between it and Harriett, no important increase could be expected from the western portion of the property. It was unfortunate that, following the completion of the big enterprise of the sinking and equipment of the Williams shaft, the developments at the bottom of the mine should not so far have come up to the expectations which appeared to have been in every way well-founded. It was worthy of note that where the lode had been cross cut at the bottom workings it had been found to be of the usual width, although there was, unfortunately, at least a temporary cessation of values, and they had not had that success in the development points at the bottom workings which they had every reason to hope would be the case. That there were very large areas of ground still to be explored in Dolcoath would be well known, and a careful study of the general position had prompted him to recommend to the directors the exploration of lodes other than the main lodes which existed on the property. To do this work would entail comparatively large sums of money, but now that such large profits were being made it was obviously the time to undertake such work.

The motion for the adoption of the report was then put and carried unanimously.

THE NUNDYDROOG COMPANY, LIMITED.

THE twentieth ordinary general meeting of the shareholders of the Nundydroog Company, Ltd., was held on March 12, at the Cannon Street Hotel, E.C., Captain W. B. McTaggart, D.L., J.P. (chairman of the company), presiding.

The Chairman in moving the adoption of the report and accounts, said that during the year 100,552 tons of quartz were treated at the batteries, yielding 80,140 oz. of bar gold, and 95,662 tons of tailing were dealt with at the cyanide works, producing 7579 oz. of gold, the total production being 87,719 oz. of gold, which realized £330,937. The corresponding figures for the previous twelve months were slightly larger, the amount obtained by gold sales being £8305 more than in the past year. The extraction by the two processes for 1912 was 17 dwt. 13 gr. of gold per ton, being the same as in the preceding year. The revenue expenditure amounted to £140,159, and the receipts (after deducting royalties £21,265) to £313,128, leaving a profit of £172,968, or £7816 less than that made during 1911. The mining, milling and general costs amounted to £1. 6s. 9d. per ton, or 9d. per ton more than in the previous twelve months. This increase was chiefly owing to 847 ft. of extra exploratory work having been undertaken and to the pumping charges being heavy on account of abnormal rains.

Including the balance of £5483 brought forward from the 1911 account, the total credits of profit and loss account amounted to £178,817. Against this sum the following debits had been made:—An interim dividend of 1s. 2d. per share paid July 19, 1912, £33,016; a second interim dividend of 1s. 6d. per share paid November 15, 1912, £42,450; income-tax, £9237; depreciation of machinery, plant, etc., £10,409; percentage to the directors and managers under the articles of association in respect of dividends for the year, £3537; additions to buildings, machinery and plant, £12,752; expenses in connection with the formation of Indian and General Mining Trust Ltd., £660; and shares appropriation account, £10,000; together amounting to £122,063, leaving a credit balance of £56,753 to be dealt with. A balance dividend for 1912 of 1s. 6d. per share was declared, payable on March 19, 1913, which would take £42,450, and leave £14,303 to be carried forward. The total dividends amounted to 4s. 2d. per share, equal to 41½% on the capital of the company, as compared with 45% distributed in respect of the previous twelve months.

Mr. Edgar Taylor then addressed the meeting. He said that the figures, although not quite equal to those of 1911, were satisfactory in that a profit of over £172,000 had been earned. The costs per ton had increased slightly; but that was accounted for by the extra amount of exploration work done, and also by the fact of their having had to pump over 5,000,000 gallons more water, an abnormally large amount. The measurement of the exploration work had been 12,943 ft. against 12,096 ft. in 1911. Four principal shafts—namely, Oriental, Kennedy's, Richards' and Taylor's—had together been deepened 813 ft. and they were now exploring at the depth of 3200 ft. (measured on the incline) at Kennedy's. They would shortly be attaining a depth where, owing to recent purchases of land, they would be in a position to extend their workings much further to the north on the line of the reef (as well as to the west in depth), and,

therefore, in order to effectively command this increase of mining area, a new vertical shaft became a contingent necessary, having in view the economical working of the mine to extended depths. They had good instances as to the advisability of this policy of deep sinking. For example, the Ooregum Company, their neighbours on the south, commenced their new shaft when they were passing through a comparatively lean period, and had been well rewarded, having come down on to quite a new series of shoots. The Champion Reef Company also had a new shaft, and they also had been rewarded by the discovery of rich ore below a poor zone, and were now in a position to work this economically.

As regards developments, during the earlier part of the year under review these were satisfactory; but during the latter part they had been passing through a poor zone at several points. This experience was nothing new to those who had been working on the Kolar goldfield for thirty years. At the 3050 ft. level, 437 ft. of driving and 278 ft. of crosscutting was done. At the commencement of this drive—the 3050—the lode was found to be divided in seams of quartz of low value over a great width, and several of these were driven on. South of the shaft there was a welcome improvement in the reef to 2 ft. in width, worth 1¼ ozs. during last January. It seemed clear that a shoot of ore was holding down here, although the length so far proved was not great. At the 2900 ft. level 1865 ft. of driving and 495 ft. of crosscutting was done, and there was now through communication between Oriental shaft and Richards'. Between these two shafts very little discovery was made in addition to the ore found during the previous year. What was revealed consisted of branches of quartz, sometimes of good value, in connection with a folded portion of the lode. Lately this folded part had been of good width, and had assayed 1 oz. 7 dwt. The 2900 ft. level north had now gone past the Oriental shaft, and here they had lately had a most encouraging improvement in the value of the ore. During January the reef was 18 in. wide, worth about 1¼ oz., and during February it had been very high grade. From the latest report the width is 18 in. and the value 1 oz. 9 dwt. At the other end of the deeper workings to the south of Richards', the 2900 ft. level had also been more encouraging of late, as the reef had improved to 16 in. in width, assaying 1 oz. They had driven 107 ft. on this new shoot, and it looked as though they were entering reef of more persistent value in this section of ground. The latest advice from here was that the lode was 3 ft. 6 in. wide, of an assay value of 1 oz. 1 dwt.

Important improvements tending towards economy in the general working of the mine had been made during the past year. The steel headgear for Oriental shaft had been delivered on the mine. New high-lift pumps were being installed at Richards' shaft, at Kennedy's shaft also the hoisting facilities had been improved, while at Oriental the new electric winding plant would shortly be provided. Equally important were the modifications in the treatment of the ore, whereby a greatly improved extraction was confidently expected.

The resolution to adopt the report and accounts was carried unanimously.

THE EXPLORATION CO., LTD.

THE ordinary annual general meeting of the Exploration Company, Limited, was held on March 11, at Cannon Street Hotel, London, E.C., Mr. R. F. Bayliss (chairman and managing director) presiding.

The Chairman said that in spite of the fact that the year 1912 was not conspicuous for the opportunities it presented for making money, they had been able to make a bigger profit, and to distribute a dividend of 7½%, as compared with 5% in 1911. The net profit earned during the year was £56,815. The balance sheet showed a strong position, as it included nearly a quarter of a million in cash on short loan and over £500,000 in investments. With regard to the latter item it was made up as shown by the following analysis:

Temporary investments of surplus funds represent	£14,090
Real estate and buildings in South Africa	60,335
South African Gold shares.....	28,313
Shares in copper-mining companies.....	94,807
Investments in American mines.....	85,302
Shares in Mexican companies	158,363
Miscellaneous industrial securities	61,006
	—
	£502,216

The shareholding in copper mining companies showed a reduction of £60,000 as compared with last year, but he would remind them that a large proportion of the profits of the company had been derived from this source during the past few years, and it was the intention of the board to, if anything, expand the investments in this direction.

The investments in Mexican mining ventures had been increased by £60,000, chiefly accounted for by the shares in the Buena Tierra Mining Company, in which they had received 99,906 shares. With regard to the El Oro, the recent active developments had greatly improved the position at this mine, and an additional piece of adjoining property had also been acquired. The Santa Rosa mine had been a disappointment so far, because, though the ore reserves were considerable, metallurgical difficulties had presented themselves. Mr. W. K. Betty was now investigating the beneficiation of this very refractory ore.

Their investment in the Tomboy Company in Colorado was in an exceedingly satisfactory condition, for the mine had been given a new and extended lease of life by the recent purchase of the Revenue properties, containing a continuation of their orebodies, and the property is now equipped on a larger scale. The china-clay venture had not progressed far, for though they had examined many deposits in the West of England, they had not seen anything yet that was desirable.

Since the meeting held a year ago, he had made a tour of inspection of Rhodesia. What he saw during his visit impressed him very favourably, and he had returned with a strong conviction that Rhodesia, both North and South, offered a most attractive field of operations for those who regarded mining from a commercial and industrial point of view. He believed that Rhodesia would become a large producer of the precious and baser metals. He concluded by moving the adoption of the report and accounts.

Mr. Harry Mosenthal seconded the motion, and it was carried unanimously.

WHEAL KITTY & PENHALLS UNITED, LTD.

THE twelfth ordinary general meeting was held on February 11 at Salisbury House, E.C., Mr. J. H. Collins (chairman of the company) presiding.

The Chairman said he must confess some disappointment at the poor results so far realized by the new workings on the Wheal Kitty lode at the 730 ft level, near the bottom of Sara's engine shaft. Then tin sales had been practically the same as in the previous half-year, but the increased price benefited them to the extent of £920. On the other hand, they had had to raise and treat nearly 8000 tons of stuff instead of only 6000—also there had been a notable increase in the wages paid to the miners underground. All this, in addition to the burden of the new Insurance Act, had resulted in an increased mining and development expenditure of £1200. Their greatest trouble was that their lodes had been for some time past unusually small and poor. Without finding anything like a bonanza, which was always a possibility in the St. Agnes district, they might reasonably expect an early increase of width in the lodes and an improvement of yield to the extent of 5 lb. per ton. Of course they could not be certain of 5 lb. or 1 lb., but they had great areas of lode to test by driving and sinking, and that was what they were now doing. Although the mines were poor at present, he did not think they need be unduly concerned as to the future. The chances of mining were great in the St. Agnes district, and when they were, as now, at the bottom of a trough, so to speak, then was the time to look for a wave of improvement. High as was the price of tin at present it seemed just as likely to rise still higher as to fall. They had no doubt noticed that although there had been a profit on the half year's operations of nearly £500, or considerably more than was necessary to pay the preference dividend for the half-year, no dividend was recommended. That was simply a measure of precaution in view of the fact that they had so little uncalled capital, and that mining, especially in St. Agnes, must always be variable in its results. Just now the mines were poor generally, but they had good hopes and good expectations of a speedy improvement, and if this came about, they would be able to pay an interim dividend without waiting for next August, and very soon also be able to resume the payment of dividends on the ordinary shares.

Mr. A. Pearse Jenkin seconded the resolution for the adoption of the reports and accounts, and it was carried unanimously.

SOUTHERN SHAN STATES SYNDICATE (1909), LTD.

THE adjourned second annual ordinary general meeting of the Southern Shan States Syndicate (1909), Ltd., was held on February 27 at Salisbury House, E.C., Mr. F. W. Baker presiding.

The Chairman said they would remember that the meeting held on May 31 last was adjourned, owing to the delay in receiving details from Burma.

They owned £50,000 debentures in the Mawchi Tin & Wolfram Mines, Ltd., which cost £48,751. 7s. 6d. These debentures were convertible into Mawchi

shares at 25s. per share, the conversion period running up to June 1914. They also owned 70,000 Mawchi shares. They held an option till June 1914, over 49,993 shares at par. The directors looked upon this option as a very valuable one, as the recent independent report made by Mr. Kuehn upon the Mawchi mine had fully endorsed the value put upon it by their own engineers. With regard to the gold-copper property at Calaw, they had options over a considerable area in which certain ancient workings existed. One of the company's engineers was making tests.

The Mawchi Tin & Wolfram Mines, Ltd., owned an area of about ten miles, a large proportion of which appeared to be stanniferous, and which the present resources of the Mawchi Company made it physically impossible to develop at one time. It was, therefore, not unlikely that in co-operation with the Mawchi Company they might have opportunities for an outlay of a part of their capital in the development of some of the remaining unprospected nine miles of territory. Before this large unexplored territory could be opened up, further capital would have to be laid out in the improvement of transport facilities, not only for the importation of machinery, but for the exportation of the tin that would be the result of a large plan of operations. There had been shipped from the Mawchi mine since November 20, 1912, no less than 67,000 lb. of tin and wolfram concentrate. Of this amount, roughly 27,000 lb. was hand-picked by the Mawchi Company from ore taken from the drives on the one mile, the balance, 40,000 lb., being bought from the natives. The buildings for the mill were nearly completed. All the excavations for the wire rope-way from the mine to the mill were finished.

Mr. R. P. Hornby seconded the resolution for the adoption of the report, and it was carried unanimously.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry K. Merton & Co. Tons of 2240 lb

	Jan 31	Feb 28	Dec. 31
	Tons	Tons	Tons
In England	25,420	25,937	22,527
In France	4,278	1,084	4,534
Afloat from Chile	2,500	2,325	2,200
Afloat from Australia	6,000	5,800	4,000
In Rotterdam	1,400	1,100	5,500
In Hamburg	3,503	4,427	4,803
In Bremen			2,450
In other European Ports			2,500
Total European visible supply	45,101	44,673	47,574

AMERICAN COPPER PRODUCERS ASSOCIATION'S FIGURES
In Tons of 2240 lb

	Production		Deliveries		Stocks at end of month
	Total	Domestic	Foreign	Total	
Total, 1911.....	639,258	316,791	337,009	653,800	
Total, 1912.....	706,052	365,920	333,212	699,132	
January	64,053	29,111	26,956	56,067	55,000
February	58,460	26,641	32,219	58,860	54,000
March	60,822	34,190	34,682	68,872	46,550

PRODUCTION OF GOLD IN THE TRANSVAAL

Year 1912	Rand		Else-where	Total	Value
	Oz.	Oz.	Oz.	Oz.	£
1912	8,753,563	370,731	9,124,299	38,757,560	
January 1913	760,981	28,409	789,390	3,353,116	
February	702,394	31,728	734,122	3,118,352	
March	760,323	30,228	790,552	3,358,050	

COST AND PROFIT ON THE RAND

	Tons	Yield per ton		Cost per ton		Profit per ton		Total profit
		s.	d.	s.	d.	s.	d.	
1911.....	23,888,260	27	7	18	0	9	7	11,114,863
January 1912.....	2,067,161	27	6	18	10	8	11	997,557
February	1,980,396	28	3	19	2	9	2	907,192
March	2,163,998	28	1	18	11	9	0	1,204,764
April	2,059,562	28	6	19	0	9	8	1,605,920
May	2,177,348	28	6	18	9	9	10	1,073,534
June	2,110,657	28	5	18	6	10	1	1,063,633
July	2,149,785	28	6	18	8	9	11	1,061,089
August	2,121,455	28	9	18	10	10	0	1,955,315
September	2,081,295	28	7	18	8	10	0	1,040,820
October	2,200,709	28	0	18	3	9	10	1,079,334
November	2,155,690	28	2	18	5	9	10	1,059,864
December	2,181,305	28	0	18	0	10	3	1,129,372
January 1913	2,296,948	27	8	18	0	9	9	1,113,579
February	2,100,137	27	11	18	3	9	9	1,019,774

NATIVES EMPLOYED IN THE TRANSVAAL MINES

	Gold mines	Coal mines	Diamond mines	Total
January 31 1912.....	184,046	7,895	9,524	201,375
February 29	180,320	7,922	10,759	209,001
March 31.....	199,748	8,198	12,071	217,017
April 30.....	197,967	8,264	13,785	220,080
May 31.....	199,829	8,269	14,538	216,827
June 30.....	188,494	8,529	15,530	212,553
July 30.....	182,625	8,497	15,834	207,256
August 31.....	174,111	8,766	15,974	203,811
September 30.....	180,799	8,783	15,732	205,274
October 31.....	182,058	8,896	15,499	206,357
November 30.....	186,881	8,767	14,872	210,520
December 31.....	191,316	8,604	14,965	214,915
January 31, 1913.....	200,090	8,789	15,912	224,791
February 28.....	207,662	8,877	15,918	230,457
March 31.....	207,733	9,069	15,041	231,783

GOLD OUTPUT OF INDIA

Year 1911	Year 1912	March 1913	Year 1913
£2,130,050	£2,265,094	£1,471,5	£557,676

PRODUCTION OF GOLD IN RHODESIA

MONTH.	1899	1910	1912	1913
	£	£	£	£
January.....	204,666	227,511	214,918	220,776
February.....	192,497	203,888	209,744	208,744
March.....	202,157	228,385	215,102	
April.....	222,700	228,213	221,476	
May.....	225,032	224,888	234,407	
June.....	217,600	214,709	236,867	
July.....	225,234	195,233	240,514	
August.....	228,296	191,423	239,077	
September.....	213,249	178,950	230,573	
October.....	222,653	221,928	230,072	
November.....	236,307	240,573	225,957	
December.....	233,397	199,500	218,661	
Totals.....	2,623,788	2,568,701	2,707,368	

PRODUCTION OF GOLD IN WEST AFRICA

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
January.....	15,903	£66,107	26,098	£107,262	31,857	£144,267
February.....	15,179	£63,081	25,009	£102,270	32,541	£137,038
March.....	16,387	£67,673	27,228	£111,796		
April.....	17,237	£70,880	27,790	£114,796		
May.....	24,427	£96,409	28,015	£115,678		
June.....	22,555	£92,174	27,784	£114,667		
July.....	22,510	£91,955	30,974	£127,800		
August.....	25,385	£103,753	33,015	£136,467		
September.....	26,717	£109,039	34,491	£142,397		
October.....	26,826	£109,503	34,436	£142,414		
November.....	24,289	£99,299	33,183	£137,700		
December.....	24,369	£99,569	34,917	£144,382		
Totals.....	261,784	£1,069,412	362,940	£1,497,179		

PRODUCTION OF GOLD IN WESTERN AUSTRALIA

	Export oz.	Mint oz.	Total oz.	Total value £
Total, 1910.....	363,496	1,209,856	1,573,352	6,682,042
Total, 1911.....	160,021	1,210,447	1,370,468	5,823,522
Total, 1912.....	83,589	1,199,080	1,282,669	5,449,057
January 1913.....	9,738	94,967	104,705	444,756
February.....	8,780	92,207	100,987	428,963
March.....	754	97,015	97,769	115,294

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	March 1913	1913 to date
Victoria.....	2,138,000	2,039,400	168,000	435,600
Queensland.....	1,623,390	1,484,160	100,250*	187,750
New South Wales.....	769,353	702,129	41,963	157,932
New Zealand.....	1,808,099	1,345,115	116,756	361,982

*February figures only.

SALE OF TIN CONCENTRATE AT REDRUTH TICKETINGS.

	Tons	Value	Average
Year 1911.....	6154	£702,599	£114 3 5
Year 1912.....	6992	£831,908	£128 5 6
January 6, 1913.....	251	£32,769	£141 17 2
January 20.....	2574	£36,647	£142 9 1
February 3.....	204	£36,221	£138 18 1
February 17.....	206	£32,393	£137 5 2
March 3.....	2521	£33,251	£131 13 9
March 17.....	209	£29,302	£127 19 2
March 31.....	258	£34,256	£132 15 6

EXPORTS OF TIN AND ORP FROM STRAITS AND BOLIVIA

Reported by A. Strauss & Co.

	1912 tons	Mar. 1913 tons	1913 tons
Metal from Straits to Europe and America.....	59,036	4,725	15,448
Metallic Content from Bolivia to Europe.....	21,149	1,700	5,147

REVIEW OF MINING

INTRODUCTORY. — The bourses are still looking toward the Near East, whence comes continued perturbation. A month ago it was expected that the capture of Adrianople would end the Balkan war. When that event was announced a feeling of relief was apparent, but it was promptly checked by the complications over Scutari. It appears now as if this episode can be settled without further embroilment, and that it will, temporarily, end the political crisis in Eastern Europe. Meanwhile, the markets are marking time. It is remarkable how well sustained they have been during the long-drawn depression. This augurs well for the future, when immediate cause for anxiety is removed. In America the revision of the tariff appears to be accepted with equanimity, and financial conditions are healthy. The low price of metals is threatening the prosperity of many mines, but as the metal market's depression is due to conditions arising from the war, it is expected that a recovery will be registered when that cause is removed. At present, business in London is dull to dreariness, and mining affairs are flat to extinction, but quiet work is in progress, and the first restoration of confidence will stimulate a return to speculative activity.

The mining department on the Paris bourse has been shaken by the collapse of speculation in Dos Estrellas, a mine at El Oro, Mexico. At the end of February the price was 495 francs per share; the latest quotation is 330 francs. Since the recent placing of these shares on the French market the fall has been 400 francs per share, equal to a gross loss of 50,000,000 francs. It is not surprising that the débâcle affected Mount Elliott shares, on the receipt of adverse news from Queensland. We only wonder at the comparative firmness of Camp Bird and Mexico of El Oro.

TRANSVAAL.—The yield of gold for March is a record, always excepting March of last year, when the reserve was extinguished. A gain of £239,698 as against February looks splendid, but the output per diem was 25,502 ounces, against 26,218 ounces in February. The labour statistics show an increase of 1326 natives employed on all the mines of the Transvaal, but the gain at the gold mines was only 71, as against an increase of 6428 in the corresponding month of last year. However, the total of those employed, namely, 207,733, is the highest recorded, comparing with 196,748 a year ago. The supply now is equal to 93% of the demand.

The report of the East Rand Proprietary for 1912 shows that many improvements have been introduced by Mr. H. Ross Skinner, the new superintendent engineer, and Mr. W. T. Anderson, the new manager. By cleaner mining, reduction in stoping widths, and closer sorting, as well as by a more judicious selection of ground, the content of the ore milled has been increased, and the yield per ton has been raised to 32s. 1d., as compared with 25s. 4d. during 1911. Owing to a change in the method of presenting accounts, it is not possible to compare costs of mining without entering into too great detail. Metallurgical treatment has been improved, the cost having been reduced from 4s. 8d. per ton in January to 3s. 9d. in December, and extraction has been raised by 4%. The resulting profits, as far as shareholders are concerned, are reflected in a 25% dividend. This compares with the 40% confidently expected by the late controllers. Development has been suspended in the Driefontein section, which contains the best quality of ore, until additional pumps can be provided, and in the meantime the ore developed has not equalled the amount raised as regards

quantity, though the results as regards quality are distinctly gratifying.

The Van Ryn Deep, the Barnato deep level in the far east Rand, is expected to commence milling in three months. The equipment includes 80 stamps of 1900 lb. and 8 tube-mills. The capacity will be 40,000 tons per month which at 25 milling days per month means a duty of 20 tons per stamp. The developments during 1912 have been gratifying, for whereas on December 31, 1911, the reserve was 600,000 tons averaging 7 dwt. per ton, the figures a year later were over a million tons averaging just under 8 dwt. per ton. The best results have been obtained in the central and eastern sections, and less satisfactory ore has been found in the western end. There appears every prospect of keen rivalry between this new producer and its neighbours, the Brakpan and New Modderfontein.

Developments during the last year at the Meyer & Charlton have disclosed ore of higher grade than that of recent years, so much so, that the ore reserve on December 31 last showed an increase in tonnage and an increase of 2 dwt. in the content. The present position may be judged by the fact that the ore developed during 1912 averaged 11 dwt., and the ore milled 9 dwt. The results for 1912 in the way of dividends were the best on record, and those for the current year promise to be even better. At the present time, this mine is the star of the Albu group, and goes far in compensating for disappointments at some of the other mines under the same control.

We welcome the return of the Consolidated Mines Selection Company to the list of dividend payers. For some years speculative dealings in African business have been restricted, and this company has been accordingly under a temporary cloud. The arrival of the Brakpan at the profit-earning stage has brought a steady source of income to this company and even more so to its original parent, the Transvaal Coal Trust, which is now earning

bigger profits from the gold on its estate than it ever earned from coal.

For some time the City Deep has been worried by assertions relating to the validity of its mining and claim titles. The opposing party, however, failed to appear in court, so that judgment was given without opposition in favour of the company. Thus comes to a close an unsettling incident in Rand circles.

The Springs Mines reports the cutting of the gold-bearing conglomerate at a depth of 3432 ft. on the No. 1 vertical shaft, at the northern extremity of the property. This company is under the same management as the Brakpan, and the property is on the dip of the Geduld. In fact, Springs is a 'fourth deep,' having the Geduld, Government Gold Mining Areas, and Modderfontein B above it. The thickness of the 'reef' averages 35 inches; the assays in the shaft vary considerably, for the northern 30 ft. averages 3 dwt. while the southern 12 ft. averages 10 dwt., the whole averaging 5'93 dwt. over 34'9 inches. The depth at which the deposit would be reached was estimated at 3150 ft. This has been exceeded, owing to reverse faulting. The depth of No. 2 shaft at Geduld, 3½ miles away, is 1695 feet. To develop the mine, £315,000 is being provided by the issue of debentures.

The decision of the General Mining & Finance Corporation, the holding company of the Albu group, to distribute no dividend for 1912 is a prudent measure. The conditions of the money, share, and labour markets were much the same as in 1911, and for that year also no distribution was made. Several of the mines belonging to the group are requiring funds for development and at some the present prospects are not over bright; but the times are not such as to warrant the policy of creating new shares and offering them for subscription. Consequently large sums of the holding company's capital are locked up in the subsidiary enterprises, and more may be needed. It has also been deemed desirable to make full allowance in the

balance-sheet for the fall in the quotations of the shares of the subsidiary companies.

RHODESIA.—The February statistics show a decrease in the gold output, to £208,744, but this is due mainly to the shortness of the month. A year previous the output was worth £209,744. The end of the drought has been signalized by an increase in the number of producers, from 172 to 180. Among the notable changes is a decrease at the Globe & Phoenix, from 6043 tons to 4636, and from £38,416 to £33,232. Obviously the smaller tonnage is partly compensated by the crushing of richer ore. The Lonely Reef did well, increasing its output to 4066 tons and the yield to £16,230, as against 3050 tons and £11,700 in January. The Wanderer shows a serious decline, to 16,400 tons, yielding £5604, as against 20,000 tons and £7602 in January. The Jumbo worked at a loss.

On the Shamva's fourth level the orebody has now been traversed for 80 feet, averaging $5\frac{1}{2}$ dwt. per ton. This compares with 65 feet of 6'31 dwt. stuff on the 3rd level. The difference in grade is more significant than the increased width.

Some activity is shown in prospecting for tin in the Enterprise and Victoria districts. The most lively mining centre in Rhodesia just now is Gatooma, which is the distributing point for the Cam & Motor, Eileen Alannah, Masterpiece, Turkois, Cheshire Cat, Shagari, and Arlandzer mines.

WEST AFRICA.—The returns published by the Chamber of Mines indicate a decrease in the gold output, from £144,262 in January to £137,038 in February. This decrease is more than explained by the shortness of the month. In February 1912 the output was £102,270. We note that both dredging companies are doing well, each producing about £2000 monthly. The only serious decrease is at the Abhontiakoon, from £22,065 in January to £17,114 in February.

The Ancobra Dredging company showed

commendable sense in testing the extensive flats before placing a dredge on the ground. These flats had been worked by the natives, largely by slave labour, so that even poor ground was worth digging. Systematic borings by the company have proved the ground too poor to warrant the necessary capital expenditure. Meanwhile several patches of richer ground have been found nearer the river. A favourable report on the company's prospects has been made by the new manager, Mr. Claude Gregg, who is experienced in West African mining.

At last the Ropp shareholders have been given some information from the mine. During the four weeks of silence, the shares have been the most active counter on the Nigerian market. We are not favourably impressed by the reports now issued. The geological references are unscientific. Nor is the technology convincing. A ludicrous suggestion is made that a putative dike may become "the basis for a large dredging proposition." We are informed that "no systematic sampling has been carried out." Why not? Surely that should be the first step.

The Jos made an output of 56 tons of tin in March, this being the highest recorded, comparing with $47\frac{1}{2}$ tons in February. The machinery for the bucket-dredge is now being assembled.

AUSTRALASIA.—The Consolidated Gold Fields of South Africa has secured an option on the Mount Oxide copper mine, in the Cloncurry district of North Queensland.

The Bullfinch mine has had its first clean-up, with the result that gold worth £15,537 was extracted from 5178 tons milled by the 15 stamps during the six weeks from February 15 to March 31. It is estimated that additional gold worth £9000 has been absorbed or is in circulation in the plant. The cable message frankly states that ore of higher assay-value than the average is being treated at the start. The yield was 60s. per ton milled,

and the "total mine expenses" were £5018.

Labour is the predominant factor in Australia at present. The supply is scarce, and wages are high. Moreover, the government of the country is in the hands of the Labour party. The situation at Broken Hill is serious owing to a strike on the Silverton tramway, which connects the mines with the South Australian railways. The demand of the labour-union is that all employees shall join their ranks. If no settlement can be effected, most of the mines will have to suspend operations within a short time.

The Moore Filter company has commenced an action in New Zealand against the Talisman mine for infringement of its slime-filtration patents, with the purpose of testing the opinion of the Australasian courts as to the validity of their claim to the control of all vacuum or pressure filters for the treatment of slime in connection with the cyanide process. The Australasian mine managers are combining to resist this claim.

The fire at the Consols mine of the Mount Elliott copper company, Queensland, has proved to be more serious than was supposed when we wrote last month. Mr. W. H. Corbould, the manager, has found that he is unable on account of the fire to obtain the necessary sulphide flux required, so he has temporarily suspended smelting operations. This news caused a severe fall in quotations, French shareholders evincing excessive nervousness, which, as far as we can judge, was unwarranted.

The latest estimate of the ore in reserve in the Ivanhoe mine shows a fall of 2s. per ton, whereupon the board has decided to decrease the monthly profit to £14,000. This would represent dividends at the rate of 16s. per share per annum. We note with satisfaction that the estimates of the manager and the consulting engineers are in close agreement.

Owing to the interruption to smelting during the Easter holidays, the March returns

from Great Cobar are disappointing. So was the special meeting, called to enable Mr. H. C. Bellinger to address the shareholders. He explained the difficulty of obtaining an adequate supply of labour, and confirmed the estimates previously made, but gave no fresh information. In his reticence, he was wise. Great Cobar has had enough said and promised about it, and if the performance has repeatedly fallen short of the promise, it is only fair to say that Mr. Bellinger deserves more sympathy than blame. He has proved his technical skill abundantly, and, so it seems to us, also his patience and loyalty, for no mine manager during the last three or four years has had to face repeatedly so many difficulties, due to no fault of his own. The labour troubles at Great Cobar would have broken the spirit of any ordinary man. We shall be glad to chronicle the success of the enterprise for his sake, as well as that of the proprietors.

UNITED STATES.—The dispute based upon 'apex' law between the Montana Mining Company and the St. Louis Mining & Milling Company has for years been considered the 'Jardyce' case of the mining world. Like that celebrated suit, it outlived some of the parties to it; that is to say, the Drumlunnon mine has been exhausted for some years, and the legal tangle has prevented the application of the funds of the Montana company for other purposes. The end of the quarrel has now come, and the final claim of the St. Louis company settled. Way is thus clear for the re-opening of the Lucky Girl group of mines at Edgemont, Nevada, which were acquired in 1904, and made sound progress until 1908, when it became necessary to conserve the assets of the company. The lawsuit lasted nearly a quarter of a century.

MEXICO.—We discuss conditions in this country on another page. The new government is trying to restore order. Meanwhile the most serious feature is the break-down of railway transport. This threatens to cripple

industry, especially in the northern mining districts.

The San Francisco del Oro mine, a silver-lead-zinc property at Parral, Mexico, has been before the London public for ten years without yielding a profit. The ore deposit has been known to be extensive during all these years, but owing to the fact that knowledge concerning the dressing of such ores has been lacking both in Mexico and in the board-room, the progress of this enterprise has been slow, and a second reconstruction has been necessary. Messrs. Knox & Allen, of New York, report favourably on the ore reserve, and on the possibility of adapting the present concentration plant so as to produce satisfactory smelting products. A. Goerz & Co., jointly with other financiers, have guaranteed the subscription of £200,000 debentures, one half of which will be available as additional working capital. The silver-lead concentrate is readily saleable locally, and the blende product is shipped to Norway to be re-treated by the company controlling the Trollhattan electric zinc-distilling plant.

CORNWALL.—The Cornish Tin Smelting Company's works, south of Redruth, have changed hands. Owing to the weight of years, Mr. Alfred Lanyon, the founder and owner, has decided to retire, and he has sold the business to Vivian, Younger, & Bond, the London metal merchants, who have already other tin-smelting interests, particularly in the East. The technical management will remain with Mr. William Bray and his sons. We are glad that the business has been perpetuated, and not allowed to lapse, as was the case with the Bolitho's works at Chyandour, near Penzance, a year ago.

SPAIN.—The results at Rio Tinto for 1912 show a marked increase all round. The high average price of copper, £73, was the chief factor in raising the rate of dividend to 90%, but the increase in the output of copper as metal and in ore sold, from 33,385 tons to

39,925 tons, contributed notably to the profits. The sale of barren pyrite for sulphur alone also showed a substantial increase. We note with pleasure that the Cordoba company, another Spanish producer, has been doing well lately, and has been able to distribute a 20% dividend. The orebodies here are not continuous, as is the case at Rio Tinto, and much of the exploratory work yields little or no result. The concentration and smelting problems have also been troublesome, owing to the friable nature of the ore. Mr. James Hocking, the superintendent, and Mr. W. A. Heywood, the consulting metallurgist, who designed the smelting and converting plant, are to be congratulated on results. We note also that the Murex concentrator is treating the jig-middling successfully, and that the installation is being enlarged.

VARIOUS.—Misfortune still clings to the Famatina. Fresh capital for this mine in the Argentine was raised recently, and the understanding was that the resumption of smelting would place the property on a productive basis. Just as good returns were expected, the new manager, Mr. L. Parker, formerly superintendent of the mine, cables that the assay-value of the ore has been over-estimated, and the metallurgical engineer, Mr. W. G. Perkins, states that the smelting plant is incomplete. The question arises why the discrepancy was not acknowledged earlier. The last estimate was made in May.

The first weekly clean-up on the dredge started on the Pato concession, in Colombia, by the Oroville Dredging Co., showed a yield of 14 cents, the second clean-up gave 43 cents, and the third gave 42 cents per cubic yard. The good ground will be reached in two or three months, as the dredge is now cutting its way to the 310 acres previously tested by drilling. We note that our San Francisco correspondent speaks of this dredge as "going to the bottom" in February. It was recovered with but little damage. This explains the delay in getting the first results.

EDITORIAL

THE CLOSE of J. Pierpont Morgan's career marks "the passing of financial feudalism in America." This was well said by a New York paper. With the passing of the benevolent type of financial autocrat will go also, it may be hoped, the vulgar pirates who have loomed so large in American industrial life.

AT the Anglo-Continental meeting a protest was made by the minority shareholders. Again, as at the Globe & Phoenix meeting, the spokesman for the dissatisfied shareholders was twitted with his small and recent holding of shares. It is time for directors to drop this futile retort. Obviously the dissatisfied shareholders are entitled to be represented by a spokesman, chosen not on account of his share-holding, but for his qualifications as a speaker.

WHILE we are endeavouring by the help of our friends to obtain a satisfactory definition of the word 'ore,' many engineers still cling to local slang, and thereby not only write illogically, but mystify the average reader or shareholder. The reports on gold mines in the Kolar district of Mysore refer to the disclosure of a "vein of quartz," and in the Mount Boppy report the manager, a Cornishman, adopts local Australian nomenclature, and informs English shareholders of the advantages to be gained by mining a "body of stone." Let us have words that convey a correct impression, and let us use them with precision. Clear writing conduces to clear thinking.

EVERYBODY commercially interested in the prosperity of South Africa naturally welcomes any pronouncement by a geolo-

gist that can be construed into an argument in favour of the theory that the Rand deposits are fossil placers. Bulletin No. 50 of the Western Australian Geological Survey contains a reference by Mr. A. Montgomery, the State Mining Engineer, to the auriferous conglomerates of Nullagine, belonging to the Devonian series. His words are: "which are in many respects closely analogous to the bankets of South Africa;" and "it is interesting to note that in these beds the gold is pretty certainly of alluvial origin." These sentences are being freely circulated by South African papers. Evidently Mr. Montgomery has not examined the Rand deposits personally, or studied the views of those most competent to judge. The geology of some people is like the Kingdom of Heaven, "which cometh not by observation."

FOR A SECOND TIME the lease of the Brakpan-Schapenrust mining rights have been offered by the Transvaal government without any response on the part of the mining groups. The adjoining Witpoortje lease has also been advertised, so far with no result. Considering the large capital required, the restrictions on the method of issue of the shares, the low grade of the ore, and the great depth of the deposits in the far east Rand, the royalty required by the Government seems inimical to the mining interest. The royalty is based on the ratio of profit to yield, and progresses from 10% when 10% of the yield is profit, up to 45% when 60% of the yield is profit. The contract in connection with the Brakpan-Schapenrust called for the expenditure of £1,200,000 in shaft-sinking and equipment, and that of the Witpoortje for £720,000. The Transvaal is a country of vast capital expenditure, so that the conditions may not seem so

onerous there as in other parts of the world. Nevertheless, the slice of profit demanded by the Government is not encouraging to mining speculation.

INTRODUCTION of the chemical assay in connection with tin ores has shown that a substantial proportion of the tin is not extracted in the concentration plant, and many people have blamed current practice for the imperfection of results. In spite of close study, some of the cleverest men, both Cornish and outside, have failed to improve the extraction, or, in fact, to obtain a greater yield than that indicated by the vaning-shovel assay. In a recent issue we advocated the investigation of the physical condition of the tin in the ore, for it is obvious that a close mineralogical analysis is a necessary adjunct to the chemical assay. We have pleasure, therefore, in publishing in this issue an article by Mr. H. W. Hutchin, in which he gives the results of his investigations along this line. The article was presented as a paper at last month's meeting of a new technical society in Cornwall, but we feel that Mr. Hutchin deserves a wider audience. One of the points he makes is that some of the tin is so intimately dispersed through the dark silicates as to be practically unrecoverable by water concentration, and that a portion of this tin may itself be in the form of silicate. Further discussion and investigation of this subject will be acceptable.

AN OIL INSTITUTE is to be founded, we hear, on the same lines as the kindred societies devoted to mining, the metals, engineering, and chemistry. Now that oil is playing so large a part in fuel and power problems, an association of those interested is undoubtedly desirable. The gentlemen who have this object in view aspire to establish a code of professional practice. We would suggest, in view of recent happenings, that one of the definite rules adopted should ban the pretence

of giving reports concerning properties without an actual personal inspection. We know quite well that directors, promoters, capitalists, and investors, in their individual or corporate capacities, ask the advice of a consulting engineer as to the nature of a proposition put before them by someone else, and the engineer is perfectly justified in expressing his opinion on the statements and opinions contained in the reports submitted to him, without his proceeding to the property to make an independent investigation. But such opinions are only given privately, usually verbally, and under limitations that are perfectly well understood. It is quite contrary to the interests of investors and to the profession for an engineer to write a report for publication based on hearsay or second-hand information. Such a report may contain a frank statement of the conditions under which it is written, but the ordinary investor does not read reports in detail, relying in a general and vague way on the name of the engineer and on his opinion, implicit or explicit. Therefore, we say to the new Institute: discourage the publication of a report unless it contains the writer's own opinions based on actual examination.

RECENTLY we made mention of the absorption of gold by the natives of India, suggesting that this was a fact as significant as the increased output from the Witwatersrand. In his presidential address, Mr. Bedford McNeill quoted interesting figures on this subject from Sir James Wilson, who has calculated that 423 millions sterling has been absorbed by India during the 70 years ending in 1910. Another authority, Sir Edward H. Holden, estimates that 30 millions sterling will be sent to India during the current year. These are stupendous figures, for the entire output of the Transvaal was £38,750,000 last year, and the total production of the world was only £98,500,000. A similar hoarding of gold is observed in Egypt, which in 1910, for

example, absorbed 6 millions sterling, according to Lord Cromer. Such facts militate against the theory that the high price of living is due directly to the growing production of gold. Another factor opposed to this popular notion is the increased use of credit. As we become civilized we do business increasingly on credit. The policeman, as the sign of law, and the cheque, as the symbol of trust, express civilization more truly than buildings or books, statuary or steamships. To hoard is to be a barbarian, fearful of his fellow-men and distrustful of the community in which he lives. The most sinister example of hoarding is that of Germany, which keeps £80,000,000 of the French indemnity in cold storage. Similarly, the French banks are storing gold to such an extent that, at the present time, none of it is available to their ordinary customers. Not less than £130,000,000 is said to be accumulated, largely as against the contingency of war. It needs only similar distrust on the part of half-a-dozen multi-millionaires to plunge New York into a panic: it needs only a like lack of confidence on the part of a few thousand bank depositors to plunge London into confusion. On the other hand, if everybody could trust everybody as we trust our friends, it would be unnecessary to pay in gold, for every cheque that passed current between individuals would express a liquid asset or a commodity immediately exchangeable. To use gold in business is almost as uncivilized as to buy and sell with cowrie shells.

Mexico.

During the last four weeks the situation in Mexico has improved. The most satisfactory event was the opening of Congress by President Huerta, who made a patriotic speech appealing to all Mexicans to assist in the pacification of the country. He announced that a standing army of 80,000 men would be raised. This speech was received with great enthusiasm. The presidential election is to

take place in July, when General Huerta will not be a candidate. It is probable that either General Felix Diaz or Señor P. De la Barra will be elected. Meanwhile in the North the counter-revolution under General Carranza appears to be gaining ground, the Federal troops having been defeated in a battle at Rampazos. These insurgents have proclaimed the independence of the four northern states, and now appeal to the United States, expressing willingness to be annexed. It is not likely that the offer will be accepted, as it would, of course, involve a war with Mexico, preceded by a massacre of Americans in Mexico. Undoubtedly Sonora, Chihuahua, Coahuila, and Sinaloa are already much Americanized and are the least subject to discipline from the capital. At the present time, no communication, by post or telegraph, is possible with the northwest of Mexico, the cattle of the big American ranches has been lifted by marauders, and the mines operated by Americans are shut-down. From an economic and industrial point of view, the annexation of this region to the United States would involve no great strain, but it is most improbable, for the reason already stated, and for others into which we need not inquire at present. While Orozco and Zapata have made peace with the *de facto* government, the disorders in the North have been renewed by adherents of the Madero family, helped, it is said, by Standard Oil money. In this Mexican turmoil, it must be remembered, the machinations of capitalistic groups provide a sinister background. The elder Diaz was supposed to be a friend of the Pearson people, while Madero received assistance from their rival, the Standard Oil. Now that Felix Diaz is on top, it is assumed that a new regime of *cientificos* and *hacendados* is in the saddle, supported by the military element. This combination is expected to be sufficiently powerful to ensure the pacification of the country. The probability of such a consummation depends upon whether the new

government can suppress revolt more rapidly than they arise in opposition. We think it can. The northern confederacy will succumb when it becomes clear that no overt assistance is likely to be forthcoming from the farther bank of the Rio Grande. Then it becomes simply a question of amicable co-operation between the leaders who recently combined against Madero. For this we hope devoutly, for therein lies the one chance that Mexico may return to peaceful progress and to the industrial development on which friend and foe are so largely dependent.

Copper in Arizona.

On another page we publish a letter from Globe, in Arizona, giving timely information concerning the big copper enterprises in that region. The development of new mines is hardly more important than the continuation of old undertakings. Nothing in technical progress is more striking than the manner in which modern specialists, like Mr. L. D. Ricketts, have been able to re-construct the old concentrators and re-model the smelting plants in Arizona, so as to treat the ore more efficiently, and to render large bodies of low-grade ore profitable. The close concentration of these low-grade ores involves two chances of loss. The roasting of fine concentrate causes the formation of an excessive proportion of dust in roasting, and, to a less degree, in smelting. Careful study is being given to this phase of the metallurgical treatment, and the new plants are designed so as to minimize such loss in dust. Roasting-furnaces are now being made, both in America and Europe, from which practically no dust escapes. Sintering and briquetting make the products more amenable to the blast-furnace, and the reverberatory treats fine material efficiently. In concentration, the loss is much greater; the best practice recovers barely two-thirds of the copper in the 'disseminated' ores of Arizona, for the finely divided chalcocite defies any-

thing like a complete recovery by the ordinary methods of wet concentration. Oil flotation, it is hoped, will come to the aid of the perplexed metallurgist. Experiments now being made not only at the Inspiration mine, as mentioned by our correspondent in Arizona, but also at the Braden, in Chile, at the Great Fitzroy, in Queensland, at the Great Cobar, in New South Wales, and elsewhere, are being watched with keen anxiety, and they are full of promise. The stumbling-block to concentration of any kind is often the variety of the copper minerals in the ore. A mine will yield native copper, oxide, carbonate, and silicate as well as the sulphides, the chief of which in Arizona is chalcocite. Only careful and protracted experiment will show whether material so varied can be treated to such advantage as to make it worth while to abandon present methods and equipment. Large quantities of oxide, carbonate, and silicate are known to exist, to which neither flotation nor ordinary concentration is generally applicable. Occasionally the nature of the oxidized mineral and the gangue is such as to make water-concentration possible, and specific cases may be quoted. The Arizona Copper Company treats oxide ore in this way, the concentrate being sent to the smelter, while the tailing is leached. At the Bwana M'Kubwa mine, in Northern Rhodesia, a dressing plant is in operation for the treatment of carbonate. A similar plant is now on its way to Collahuasi, Chile. The concentration effected in this way is not close; all that is done is to remove as much oxidized mineral as possible in a condition suitable for the smelter, leaving a large proportion behind to be treated by leaching, if the economic conditions warrant. The study of leaching is being actively conducted in Arizona, and other copper districts in the west of America, as has been recorded in our pages from time to time, though no new process has yet been evolved. Some of the English and American papers have recently contained

vague references to a leaching process that is alleged to have proved a success in Montana, but the details are lacking. It is presumably the Leach process, which was mentioned in our February issue. The opportunity of profit and increased production in connection with copper ores is vast. In Arizona alone, 70,000 tons of the metal is discharged in the tailing every year, as compared with 150,000 tons actually recovered. We note with interest that two American firms of machinery makers have recently placed on the market effective machines intended for the concentration of copper slime. One may be described as being based on the principle of the sluice and riffle, and the other bears resemblance to the Cornish rag-frame, though the mechanical improvements are in both cases such as to greatly increase the efficiency and capacity. But by whatever method, oil flotation, leaching, or water concentration, the opportunity for the making of a fortune out of present losses at copper mines is almost unlimited, and the introduction of a successful process would, in addition, extend the scope of profitability to many properties at present on the border-line of success.

Speculation and Investment.

In the course of the cross-examination to which Mr. Lloyd George voluntarily submitted himself at the hands of his political opponents, he had an argument with a member of the Marconi committee in regard to the difference between a 'speculation' and an 'investment.' Mr. George had bought 1000 American Marconi shares, but he sold 857 of them three days later, on the urgent advice of his broker, to whom at first he was not inclined to listen, because his intention was to hold the shares "as an investment." Whereupon he was asked if, "having parted within three days with practically the whole of his holding" he still considered it as an investment. To this he gave an emphatic affirmative.

Let us ascertain the essential difference between the two uses of money expressed by the terms 'speculation' and 'investment.' The first involves the purchase of shares or other things in the expectation that their market value will rise shortly, so that a profit may be made expeditiously. Ideas of time and risk are involved. A speculator buys on the expectation that the value of his holding will rise; he cares only for the dividend in so far as it is a factor in advancing the quotation; he looks, not to interest from capital, but to an enhancement of the principal. Since he expects the quotation to rise rapidly, he must be dealing with a fluctuating asset; in other words, the idea of risk is involved. That being so, he does not buy for a lock-up, but a quick turn. Time is an essential factor; among other reasons, because the speculator is apt to operate with borrowed money or on a margin. Usually he does not buy outright. On the other hand, the man who 'invests' is looking to interest on his capital; he buys bonds or gilt-edged shares the value of which is so assured as to eliminate the expectation of violent fluctuation in the quotation; he takes the safety of his principal for granted, and looks chiefly at the yield. To him the rate of dividend is everything. Obviously, therefore, the distinction between the two supposed classes of security is in the mind of the purchaser. Whether he is correct in considering his purchase as a speculation or an investment, remains to be proved. Whether it becomes manifest later that his speculation has the stability of an investment, or his investment fluctuates like a speculation, this fact does not change the character of his original purpose. In other words, the terms are employed subjectively. Of course, Smith may regard Brown's investment as a speculation, and Brown may return the compliment by labelling Smith's brilliant speculation only a dull investment, but until their difference of opinion has been tested by the logic of events,

each may honestly believe himself right. If Mr. George bought with the intention of holding his shares for the sake of the dividends accruing, he was investing; if he bought with the idea of making a quick turn, following upon a sharp rise in the quotation, he was speculating. If he bought under the supposition first stated, and the sequence of events proved that his supposition was wrong, then his investment has been changed, by the logic of events, into a speculation. But this result, if unforeseen and unexpected, would not invalidate his statement that, at the time of purchase, he made an investment. That was his avowed intention, and intention is implicit in the meaning of the terms 'investment' and 'speculation.' It is implicit, until we can write last year's almanac.

Mysore Gold.

The recent annual meeting of this company signalizes one of the notable achievements of modern mining enterprise. No better illustration can be afforded of the successful application of technical science to basic industry. An annual output of 232,737 ounces of gold from 299,660 tons will ensure a handsome profit in almost any mining region, but a ratio of 60% 'profit' to 40% expense represents a triumph of economics, having regard to the depth of the mine and the quality of the labour employed. We note that the chairman, Capt. W. Bell McTaggart, made a passing objection to the inclusion of income-tax and royalty among items of mining cost, but this represents the ineradicable dislike of human nature to taxes in general, rather than a technical view of the problem. The operation of mines by British companies inevitably involves payment of income-tax, and the operation of mines in the Mysore province of India with equal inevitableness involves the payment of royalty. They are an integral part of the cost of mining. The balance available for distribution is £513,845 out of the gross yield of £904,079,

so that the actual profit for the past twelve months is nearly 57% of the value of the gold extracted at the mine. Of this 57%, the sum of £381,250 is distributed in dividends, representing 42% of the yield. We do not make the analysis in order to belittle the performance of the Mysore, but to illustrate once again what a variety of meanings is given to the word 'profit,' and to emphasize the need for precision in the use of terms. Moreover, the Mysore is in an unusually strong position, for it has liquid assets of £216,592, besides a further reserve fund of £125,000. This typifies the conservative character of the management. We note that experiments in the treatment of slime by filtration have proved successful, and that the foundry at the mine has been so developed as to be able to produce a pair of 9-inch winding engines. As the latter has been done at a cost considerably less than the importation of such machinery, it is a highly creditable feat. The careful policy of the management is also shown in the size of the ore reserve, which amounts now to 1,337,998 tons, or enough to supply the mill for over 4 years. The main shaft is to be sunk to 4000 feet. Formerly the coolies descended to work by aid of ladders, and if this obsolete form of ingress and egress had been maintained a period of 5 hours daily would have been consumed in going to and from work. Now the manager can go from the bottom of the mine, at 3177 feet vertical (or 5000 feet on the dip of the lode) to his office in 3 minutes! It takes longer to go from the street to the fifth storey of a London office-building, but that is only because our people are more progressive at the mine than in the City.

The Mysore has now yielded £14,376,720 in gold and £7,000,000 in dividends. This is a fine showing, having regard to the relative inefficiency of the labour, which is, we believe, the worst of any employed in the big mines of the world. No less than 8500 workers are employed by the Mysore Company to extract

300,000 tons per annum, that is, the average duty of the employees is only about 35 tons per annum. At El Oro, Mexico, it is 100 tons. On the Rand it is 120 tons.

The sectional drawing exhibited at the meeting served to show the distribution of the stopes and indicated how conservatively this mine has been exploited; in the central workings no stoping has been done on any of the 15 deeper levels, although these all penetrate good ground. Indeed, the deepest workings generally make a good showing. The question then arises: what is likely to be the life of this mine? It is not a youngster, but it gives no signs of proximate exhaustion. However, it will be remembered that even Methuselah died. Although a man may be vigorous at 50 years of age, we do not anticipate that he will retain his capacity for another half-century. One of the shareholders—and the meeting was remarkable for the number of obviously veteran mining men among the shareholders—said that it was not unreasonable to suppose that the Mysore mine had a life of 20 years ahead of it; and if this proved so, the shareholders would get their capital back and a consistent dividend of about $6\frac{1}{2}\%$. Let us see. In 20 years the further output would be about 6,000,000 tons, involving a deepening of the mine, at 200 feet per annum, to about 9000 feet, on the dip of the lode, and the continued persistence of the orebodies to that depth. This appears like counting on improbabilities. To revert to our simile, the Mysore is like a vigorous man of 50; he may, like Gladstone, be still mentally powerful and efficient at 70; but he is not likely to be attending to business at 100 years of age. The Mysore shares stand at $\text{£}5\frac{1}{4}$; at the present time the yield is 125% on each 10s. share, so that the return is about 12%. To secure the return of his capital and $6\frac{1}{2}\%$ upon it, the shareholder expects a continuance of the present rate of output for 14 years. This expectation of life is too high. It is contrary to experience.

Anglo-Continental.

Our readers may be forgiven for feeling weary of the story of the Jemaa fiasco; we are weary of it ourselves, for it was, and still is, an episode calculated to undermine public confidence in mining administration. Yet we revert to the subject, feeling strongly that out of this disgraceful affair we may extract some useful lessons. Unless such affairs serve as a warning, they will be repeated. We desire to prevent a repetition.

At the annual meeting, the chairman, Mr. W. F. Turner, gave a summary of events, beginning with the wild telegrams about the richness of the Jemaa lode and ending with the final abandonment of that part of the company's enterprise. We shall not question the chairman's good faith, but we must question his good sense as a managing director. He should have known that the local manager, who sent the excited cablegrams, was not qualified, by training or experience, to pass judgment on a matter involving millions sterling. We understand that the local manager was recommended to the company as a prospector, with all the limitations obviously involved. Again, what reason was there to believe that the next manager, who also sent misleading reports, was qualified to express an opinion on a tin deposit? He had had "a long experience on the West Coast" says the Chairman. What kind of experience? In any case, experience in gold mining does not qualify a man to act as an expert in tin mining. Mr. Turner ought to have known this, and so ought Mr. Edmund Davis, who stood at his elbow. Any experienced mining engineer could have warned these gentlemen that telegrams couched in such terms as those received at that time, from men without special qualification to appraise a tin deposit, were not trustworthy. Surely they must have discussed it with some experienced engineer of their acquaintance. Was not the advice of Mr. W. R. Rumbold available? When was Mr. Rum-

bold drawn into the affair? It is proper to ask as to when he was first retained, and as to whether he was not consulted informally even before he was formally retained to act as consulting engineer. Sagacious directors have a way of getting hints even from engineer friends not on their staff. Did Mr. Rumbold visit the Jemaa in February 1912 before he became the company's consulting engineer? He sailed, it is true, on his second journey in July, when he had been officially retained, but his report was not published until October. The delay was bad enough, but the shareholders and the public, which, like ourselves, has reason to believe Mr. Rumbold to be a real expert in tin mining, are entitled to know when he was first consulted by Messrs. Turner and Davis, and whether he did not then express disbelief in the wild telegrams sent from Nigeria in December, March, and April. In justice to Mr. Rumbold, this question ought to be answered, preferably by the chairman. If not by him, then by Mr. Rumbold himself. And, again, what is Mr. Rumbold's opinion of the Naraguta Extended? The chairman makes no reference to an opinion by him, but surely the directors must have asked their one trustworthy technical advisor to inspect the Naraguta Extended, if for nothing else, to prevent a repetition of the Jemaa disappointment.

The Jemaa affair, like some other costly blunders in Nigeria, was caused by the engagement of men insufficiently experienced in tin mining and the inflation of shares consequent on their sanguine reports. The number of engineers now in Nigeria qualified to express judgment on an important tin enterprise can be counted on the fingers of one hand. If directors engage older men without special experience in tin mining, and label them experts, or if they engage youngsters without general experience, and label them eminent engineers, then they must expect trouble, and when the trouble comes they must

take the blame. That is one lesson. The other is that delay in the publication of reports, conjoined to such annoyance as Lord Harris expressed over the first independent and reliable report sent on the Jemaa, namely, that Mr. C. H. Wray, is calculated to undermine public confidence. It is the duty of directors, who, we insist, are not privileged speculators but trustees for the shareholders, to engage and to know how to engage competent engineers and then to publish their reports without delay. That is the moral of the whole disgraceful story of the Jemaa.

----- Prior Information.

Among the points arising from the Attorney General's speculation in American Marconi shares was the question as to whether the deal was prompted by access to information not generally known to the public at the time. This would be considered an advantage. It is generally supposed that if a purchase be made on the basis of data generally available, no immediate rise is likely, for the facts will have been discounted; it is assumed that if everybody bought shares on the same plane of information, the opportunity to make money would be greatly diminished; in other words, the difference in the intelligence of speculators is supposed to be not so great as to give the more intelligent an advantage equal to that accruing from priority of information. Hence most people consider it highly important not only to be well informed concerning causes affecting the valuation of shares, but to be informed before other people. The early bird, they argue, catches the worm. Those in the know are the birds and those in the dark are the worms.

On the other hand, there be wise men in the City who say that the combination of early information and banking facilities is a sure road to ruin. The argument is that information prompting hasty action, and taken without weighing its bearing upon other facts, is

likely to lead to blundering. These knowing ones, who sit back and digest facts leisurely, say that it pays better to envisage a financial position thoughtfully than to rush to the telephone as soon as a tip is given. Of the 80 men who won a fortune during the West Australian boom, only one or two are rich today. Many made some money by subsidizing subordinates in mines and getting early news of discoveries or developments. But this smartness to be informed was their undoing. They isolated facts. They failed to appreciate the inter-play of the many factors determining the value of a mine. A cross cut may break into rich ore on a lower level, but the first sample may be misleading or the orebody may prove of small extent; and even if it is all that was to be expected, it may be that the price of the shares already discounts this discovery and a few others like it. In other words, the operator clever enough to obtain prior information is apt to go off at half-cock. Obviously then the successful man will be he who gets early information and is able to appreciate its proper significance.

Another consideration must be mentioned. Is the purchase of shares for a quick turn, a short holding, or a long possession? In other words, is it a gamble, a speculation, or an investment? Time may not be the only factor of differentiation between these three modes of share-dealing, but it is the most obvious. Early information may enable the buyer or seller to make a turn before the news is generally divulged, and if the dealer gets out at the moment of excitement caused by the publication of important news, he may make money, quite apart from the real significance of the news. But he plays a dangerous game and needs to be extremely agile. Among the traps lying in wait for the unwary is the manipulation of the share-market. The intrinsic value of a mining share is one thing, the selling value of the share is another; and the two may diverge widely. To the man who specu-

lates, that is, who does not buy for a lock-up, it makes all the difference as to what view the market takes. It becomes more important for him to know who is buying and who is selling than whether a particular drift or a given winze is looking well. Shares rise when there are more buyers than sellers; they fall when the selling outweighs the buying. Of course, one buyer or seller may be so vigorous as to equal a multitude, but the idea is the same; namely, the law of supply and demand. This law may be given a fictitious operation by bull and bear tactics, and it may be confused by a company selling to one of its 'pups,' as has been done often in the Rhodesian department. Hence arise sundry conditions interfering with the value of correct information and rendering illusive even the correct inference from that information. However, one fact is plain: since priority of information is important, it is desirable, for the sake of fair play, that those who act as channels of news shall not deal in shares. This applies to all public officials, and especially to the directors of mines, to whom unusual facilities are afforded for learning the progress of developments and explorations at the earliest moment. The annoyance felt by the man in the street when it is even surmised that a Cabinet Minister has taken advantage of his official position, wholly unwarranted as it was in the case of Sir Rufus Isaacs, is as nothing compared to the irritation of a shareholder who has cause to think that any one of his directors is using his official position to facilitate speculation in the shares of a company in which he is a trustee for *all* the shareholders. To do so, is an abuse of trust; for it must be obvious that shareholders do not elect directors in order to give the latter the chance to become privileged speculators. Mining is speculative. The distribution of ore in rocks is uncertain, and the extraction of the ore is dependent upon economic conditions of a highly variable character. But the speculative

feature of joint-stock mining becomes enormously intensified by the fact that news from the mine passes through the hands of persons who may be themselves dealing in the shares. This, more than any natural or economic condition, tends to increase the danger of dealing in mining shares. To play with dice is risky; to play with loaded dice is more risky. When the public can feel assured that directors in general, as now a few in particular, are not asking them to play the game under the handicap of belated information, then the public will have reason to regard mining as less speculative than a sitting at the tables of Monte Carlo.

The Institution of Mining and Metallurgy.

The presidential address of Mr. Bedford McNeill was a notable utterance. The mining profession in London is to be congratulated on a titular chief so earnest of purpose and so sagacious of speech. We happen to know that he has also a store of that Attic salt without which human affairs so easily lose their savour, so the members of the Institution of Mining & Metallurgy may look forward to his year of office with pleasurable anticipation. The new president got in touch with realities at the very start of his address. Mining is necessarily speculative. Of course it is, and from this essential condition spring its vicissitudes and its romance, its weakness and its strength as a means of making money. The association between mining and capital is inevitable; the mining engineer is the link. On that link depends the whole chain of consequences. If the mining engineer is not trustworthy, then the mining operations performed under his advice are only a means of squandering money that might be more usefully employed in producing potatoes. In order that the public may know who is likely to be trustworthy, the profession must be organized as other liberal professions are. Thus

Mr. McNeill made interesting references to the societies that regulate doctors, civil engineers, architects, and geologists. In the case of these, discipline is assisted by authority given under a Royal Charter. Similar powers are needed by the Institution. The president said: "I hold no one should be permitted to style himself a mining engineer, or to practise as such, unless he is qualified to do so: and of his qualifications for mining, other than coal, this Institution ought to be the tribunal." This puts it tersely. So long as properly qualified mining engineers are not members of the Institution, its representative character and authority are impaired. With equal truth it may be said that so long as the Institution cannot summarily expel those who are recreant to their responsibilities, it will fail as a professional organization. In the interest of the mining industry and in defence of the public, it is desirable that the use of the descriptive title 'mining engineer' should be regularized. When authority is accorded by Royal Charter, it may be hoped that even those already members will pay stricter heed to their honourable obligations, and that like the architects, who abstain from ownership in the building materials and devices used in their work, except by express consent of their clients, so the mining engineers will exercise scrupulous care not to impair their judgment, and the consequent value of the advice given to their clients, by participating in share speculation, except by express consent of those aforesaid clients. The President does not overlook the obligations that go with the charter, even if he referred mainly to those that are financial. Larger quarters and a bigger staff will be necessary. Undoubtedly the advancement of technology is only one—we think a minor—function of a professional society. Its major functions are to facilitate personal acquaintance, to promote solidarity, and to stiffen the moral backbone of the profession. All these may be furthered by the

grant of a charter, with its concomitant increase of authority and of confidence to expand in usefulness.

The Broken Hill Proprietary.

The entrance of this famous Australian company into the iron and steel industry marks an important epoch not only in the life of the undertaking, but in the history of Australian mining and metallurgical development. The time is, therefore, opportune for a review of past achievements and of future intentions. It gives us all the more pleasure to do this in that the original discoverers and directors have always remained at the helm, and have treated the development of their property as an industrial enterprise, disdaining opportunities to acquire sudden wealth by share manipulation. While in earlier years some mistakes were doubtless made in connection with technical methods of development and beneficiation, it would be wrong for us, from the point of view of present knowledge in mining and metallurgy, to sit in judgment; and we may even go so far as to say that it was the energy of the directors and the staff that, in surmounting difficulties and correcting old mistakes, contributed to this increased knowledge and to the general advancement in metallurgical practice. Of recent years the board and management have shown rare intelligence in the art of picking the right advisors for each special occasion. In the first place, the board did well, when appointing a general manager in 1898, not to look for a specialist in mining, metallurgy, or engineering, but an all-round man who understood management, while also versed in technology, and who was sufficiently broad-minded and sagacious to delegate special duties to specialists and to seek advice in the best quarters instead of depending solely on his own judgment. That Mr. G. D. Delprat has filled these requirements there is no gainsaying. Another notable feature of the policy of the board has been to place final products on the

market, that is to say, silver, lead, and zinc as required by users of these metals, instead of being content with selling silver lead bullion and zinc concentrate, as is the custom at most of the other mines at Broken Hill. And not only so, but their policy has been to create their own markets instead of relying on metal brokers for the disposal of their products. If the company has a fault, that fault is aloofness. Metallurgical practice is not discussed as freely as many people would like, and joint action is not taken with its neighbours in labour and other sociological problems. But such an attitude is almost unavoidable where there is competition in the sale of products and in the supply of labour.

The first record of the ridge known as Broken Hill is found in Captain Charles Sturt's 'Narrative of an Expedition into Central Australia,' published in 1844. He describes it as remarkable and perfectly isolated, 350 yards long and 150 feet high, consisting of slaty ferruginous rock covered with broken masses of iron ore. The country was at that time, and subsequently, occupied by squatters, that is to say, sheep and cattle herders, and it was not until a discovery of gold in 1867 was reported to have been made on the Barrier Range that the search for minerals became a regular occupation. The gold discovery proved to be of no importance. Argentiferous galena was found in 1876 at Thackeringa, 20 miles southwest of Broken Hill, and about the same time gold was found at Mount Brown, 150 miles to the north. In 1883 rich argentiferous ore was found at Silverton, Apollyon Valley, and the Pinnacles. Lumps of chloride of silver and chloro-bromide of silver were also found in many places. Later in 1883 Charles Rasp, one of the 'boundary riders' or 'cow-boys' at the Mount Gipps 'cattle station,' when inspecting the iron cap of Broken Hill, came to the conclusion that he had found a tin mine, and with David James and James Poole applied for a mineral lease covering the

ground now known as Block 12. The manager of the station, George McCulloch, became interested in the discovery, and Blocks 13, 14, 15, were immediately pegged, and shortly afterward Blocks 10 and 11 to the south and Block 16 to the north. Mr. McCulloch formed a small syndicate among the station employees, including, besides those already mentioned, Philip Charley, George

to the public for the purpose of raising adequate working capital. The prospectus contains the names of many men still connected with the enterprise; Messrs. Harvey Patterson, Bowes Kelly, and William Jameson, among the directors, while Messrs. W. A. and T. S. Horn, the brokers, acted in the capacity of financial advisors. Smelting commenced in 1886, but the operations were far from suc-



Urquhart, and George M. Lind. Prospecting work soon proved that there was no tin, and at first the carbonate of lead exposed was of low grade. Additional money was obtained, and the membership of the syndicate raised to fourteen. The venture prospered rapidly after this second injection of capital, so much so, that the gigantic nature of the enterprise was fully appreciated in 1885, when the present company was formed and shares were offered

successful. The advice of Mr. H. H. Schlapp, from Colorado, was sought, and he effected many radical improvements. The smelter was moved to Port Pirie, whereby the cost of fuel and flux was greatly reduced. In 1886 it was found advantageous to dispose of parts of the property to other parties, and separate companies were formed during the next two years to acquire Block 10, Block 14, and Blocks 15 and 16, the last named being ac-

quired by the British Broken Hill company. By these transactions the shareholders in the Proprietary received substantial payment in cash and shares.

We have not space to describe in any detail the geology of the district and the nature of the ore deposit. Briefly, however, we may say that the capping consisted of oxides of iron and manganese, extending in some instances to a depth of 300 feet. Underneath the iron came a zone of lead carbonate interspersed with masses of kaolin. The character of the lode varied greatly according to the presence of halogen salts of silver and of dry silicious ore. In addition to smelting, leaching and amalgamation were applied, the former for the treatment of concentration products consisting of halogen salts, and the latter for the kaolin and silicious ores. Below the oxidized zone came the sulphides, and once more a new scheme of treatment had to be evolved, for the sulphides were so intimately mixed that ordinary water concentration was useless. Many smelting and leaching processes were invented and tried about 15 years ago, with the object of extracting all three metals, lead, zinc, and silver, from the complex sulphides: but none proved satisfactory. Then water concentration was tried once more, with the object of securing as much of the lead and silver as possible in a form suitable for the lead furnace. Six years ago, flotation came to the rescue of the zinc tailing, and made it possible to produce a material treatable for its zinc content. The final problem for Mr. Delprat and his colleagues was the establishment of a zinc-distilling plant. This was completed last year, and would be fully employed if only the labour-supply were adequate.

This brings the history of the Broken Hill Proprietary down to the present day. It remains to outline the new iron and steel venture. For some years the necessary iron flux for the lead furnaces has been drawn from the

Iron Knob and Iron Monarch deposits situated 35 miles from Spencer gulf opposite to Port Pirie. Over 700,000 tons of this ore averaging 68% metal has been used for that purpose. These iron ore deposits are so extensive and of so high a quality that two years ago it was decided to investigate the advisability of employing them in the manufacture of iron and steel. At the present time little is done in the production of iron in Australia, the Lithgow works in New South Wales being the solitary representative of a great industry, and over half-a-million tons of iron and steel in various forms is imported every year. The advice of Mr. David Baker, of Philadelphia, was sought, and he has elaborated a comprehensive scheme based on a daily production of 350 tons of pig iron, with basic open-hearth steel furnaces, rolling-mills for steel rails, and by-product coke-ovens. The site of the new works is Newcastle, in the heart of the most important coalfield of Australia, and the coke-ovens are to be erected there also. At present the supply of coke for the Port Pirie smelter comes from the company's ovens at Bellambi, between Sydney and Port Kembla. These will probably be dismantled later. The supply of limestone flux will come from quarries on Wardang island, in Spencer gulf, not far from Wallaroo. The boring operations at Iron Knob have disclosed immense ore reserves. The two hills rise to 350 feet and 600 feet, respectively, above the plain, and consist practically of solid ore. The outcrop extends for 6000 feet. Mining is done by open quarry, and the ore is sent by a tramway, 33 miles long, to the jetty at Hummocky Point. Space forbids a reference to other interesting features. We have touched only a tithe of the many incidents that have combined to give distinction to a great enterprise. The plans for the future promise to perpetuate the activities of the company for an indefinite period, and to continue a record of high aim and worthy achievement.

SPECIAL CORRESPONDENCE

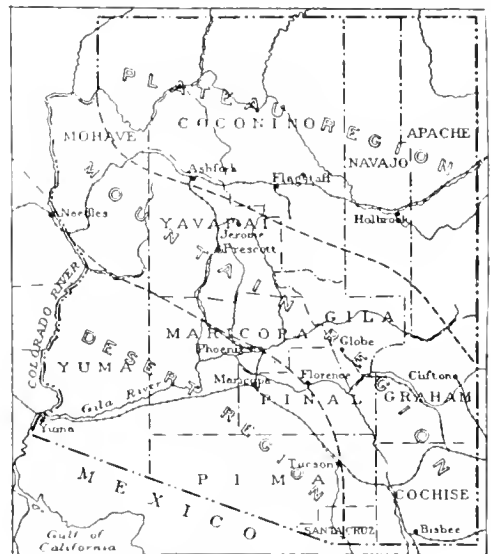
News from our own Correspondents at the principal mining centres

GLOBE, ARIZONA.

Arizona.—The leadership in copper production in the United States has for some years belonged to Arizona, that state yielding a total of 306,141,538 lb. in 1911. It seems likely to hold the premier position indefinitely, if present tendencies in the development of the industry can be accepted at their apparent import. Montana, Michigan, Utah, and Nevada, the other principal states yielding copper, derive their importance from a single large district each, though western Nevada is beginning to yield a considerable amount to add to the output of the Ely district. Arizona has no less than five important productive districts, with several others of lesser importance. Clifton-Morenci is perhaps best known in England because of the activities of the Arizona Copper Co., which is owned by Edinburgh interests, and has operated steadily for the past three decades. But in the same district the Detroit and the Shannon copper companies are both important producers. The former is one of the numerous properties of Phelps, Dodge & Co., and the latter, now controlled by N. L. Amster, is, after having passed through many vicissitudes, on the eve of paying dividends. The managerial policy of the Arizona Copper Co. has been for years exceedingly conservative, and the smelter has steadily produced dividends with antiquated equipment huddled upon a constricted site. Under the management of Norman Carmichael, and on the advice of L. D. Ricketts, consulting engineer to the company, a more expansive policy has recently been adopted: the construction of a million-dollar smelting plant, a mile below the present one and on a more roomy site, is well advanced, and the 1500-ton concentrating plant at Morenci is being remodelled, and its capacity doubled, under the direction of David Cole, who has done remarkably good work at Cananea.

Bisbee.—The most important district in Arizona is Bisbee, in the southeastern part of the state, where the Copper Queen, another Phelps-Dodge company, has been carrying on successful work for many years, and is now mining and smelting at its plant at Douglas about 2000 tons daily of direct smelting ore. The tonnage handled at the Douglas plant reaches 3000 tons daily, however, for the con-

centrate from the company's mines at Nacozari (about 200 tons per day), some silicious ore from Globe, and a variety of custom ore is smelted as well. A less well-known company, but one that bids fair to rival the Copper Queen, is the Calumet & Arizona, which, with limited smelting equipment at Douglas, has made profits amounting to \$19,000,000 in the past 11 years. This company has recently affiliated with itself the Pittsburg & Lake Superior, and now controls a large area that promises to be exceedingly productive of



Globe in Relation to Physiographic Regions of Arizona.

(After Ransome, U.S. Geol. Survey.)

good ore. A new smelter of 2500 tons daily capacity and of similar design to that of the Arizona Copper Co., is under construction at Douglas, also having been designed by L. D. Ricketts, and constructed by Repath & McGregor.

The Globe district has also been active for many years, the Old Dominion Copper Co. and the United Globe, both Phelps-Dodge companies, having been steadily productive. The importance of the area has been greatly increased, however, by the development of large bodies of low-grade disseminated chalcocite ores, occurring in intrusions of porphyry. The Miami is the only one of these to reach the producing stage as yet; it is mill-

ing daily 3000 tons of ore averaging 2.4% copper, making a 7.2% saving. The concentrate, which contains about 35% copper, and is all finer than 10 mesh, is shipped to Cananea for smelting, as the Old Dominion plant at Globe is unprovided with reverberatory furnaces and accordingly unable to treat such finely-divided material advantageously. The Miami, according to its latest annual report, has 18,000,000 tons of ore containing 2.58% copper developed in its property. The Inspiration Consolidated, which has developed 42,000,000 tons of 2% ore, and 3,000,000 tons of 1.85% copper ore, is not yet producing, the design of plant awaiting the outcome of the experiments with the Minerals Separation process. A 50-ton experimental plant has been in operation for some weeks, and the results are being carefully watched by the managers of all the important properties in Arizona, who hope to find in it a remedy for the heavy losses in concentration of low-grade ores, which are becoming more and more important as the mainstay of future production. Experimental work is still continuing, and no disclosure of results has yet been made. If the Minerals Separation process is finally adopted, a large plant will be built and the Inspiration will quickly become a big producer, for development work in the mine is well advanced. With the Inspiration has recently been joined the Live Oak, another important property. The Keystone, which lies between them, has also a considerable tonnage of developed ore. Thus the Miami-Inspiration portion of the Globe district may be expected to overshadow the older portion, near the town of Globe. Here the Old Dominion operates its mine and smelter, treating both lump ore and concentrate from its 500 ton mill in blast-furnaces. This company also handles the ore of the United Globe, which almost surrounds the Old Dominion, and though both properties are controlled by Phelps, Dodge & Co., their books are kept separately, since the United Globe has been the bone of contention in protracted litigation. The Arizona Commercial owns a good deal of adjoining ground, and has recently purchased more. This company has had an unhappy history, but is now doing some well directed development work, and promises better for the future.

Ray.—A short distance south of Miami, across the Pinal mountains, is the Ray district, where an English company for a number of years unsuccessfully endeavoured to find enough high-grade ore to permit working by former methods. Now the Ray Consoli-

dated Copper Co. has developed, by drilling and driving, nearly 80,000,000 tons of ore carrying 2.17% copper, and has more recently taken over the Ray Central, which had developed about 500,000 tons of ore with 5½% copper. The mine is producing about 6500 tons per day, which is all being treated in the mill at Hayden, on the Gila river. The mill has a capacity of about 9000 tons per day, but work at the mine is not yet in full swing to furnish that tonnage, mining having only begun two years ago. The ore is concentrated about 16 tons into one, yielding a concentrate of 23% copper, and the recovery has been gradually improved until it now is about 70%. The property is under the same control and management as the Utah Copper Co., and the methods followed are essentially similar, except that all the ore is extracted by underground mining, using shrinkage stopes and caving the intermediate pillars. The concentrate is smelted in an adjoining reverberatory smelting plant, owned and operated by the American Smelter Securities Co.

The United Verde mine is the principal producer in Yavapai county. The Consolidated Arizona, which operates a mine and smelter at Humboldt, has not done much recently. This is the high-grade district of Arizona, as the ore smelted in 1911 had an average value of nearly \$27 per ton. The United Verde has a new smelting plant, designed by L. D. Ricketts and constructed by Repath & McGregor, in course of construction, and here, as elsewhere in Arizona, the copper output will tend to increase, though the increased tonnage treated will doubtless be partly balanced by the decreasing grade of the ore.

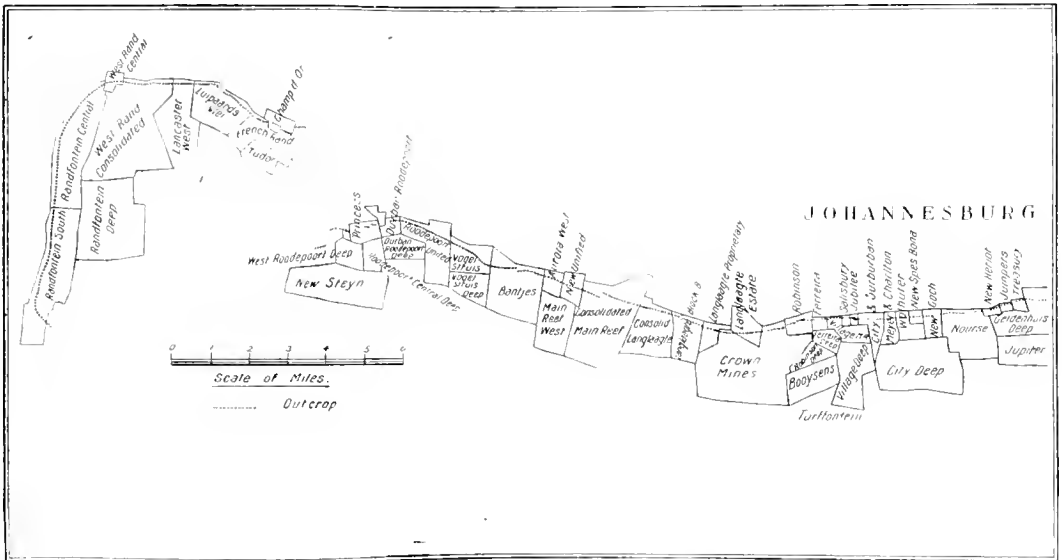
JOHANNESBURG.

Chamber of Mines.—At the annual meeting Mr. M. G. Elkan, the retiring president, gave a full account of the progress of the mining industry of 1912. The more interesting points may be summarized as follows: In the gold mines the death rate from accidents affecting white employees was 2.17 per thousand as against 3.57 in 1911. Of the total gold output 63% was absorbed by working costs, 21% by dividends, and 14% by profits tax, capital expenditure, interest, and redemption of loans. The average price obtained by coal producers was only 4s. 4.8d. per ton as against 4s. 8.4d. in 1911. 247,477 natives were supplied during the year, an increase of 38,619, or 18.5%, over 1911. At the end of 1911 the mines had 65.8% of their total complement

and at the end of 1912 this had risen to 84·6%. By the end of March 1914, the combined capacity of the Victoria Falls & Transvaal Power Co. and the Rand Mines Power Supply Co. will be 140,000 k.w. of electric plant and 61,500 k.w. of air-compressing plant. The total gold imported into India in 1912 is estimated to have amounted to £25,000,000, or a rate of increase greater than the rate of increase in the world's gold production; there is, therefore, still every necessity for augmenting the gold output. A plentiful supply of gold, other things being equal, means brisk trade and high prices, but great as is the evil of too rapidly rising prices, a scarcity of gold, falling prices and poor trade would be infinitely worse. Important, therefore, as the mainten-

ground employees are appalling, and it is probably no exaggeration to say that on average the whole personnel of the underground white labour of every mine changes twice each year, while there are cases on record where the number of changes is such that every four months an entirely new set of men have to run the property.

Mr. Elkan was flattering to the Rand in showing how important to the welfare of the world is the golden stream that flows from it; but he was a little unkind in leading the public to infer that the source of the present social unrest, due mainly to higher prices and consequent increased cost of living, is to be sought in the gold mines of the Ridge of White Waters. The most common explanation of



THE WESTERN PORTION OF THE RAND.

ance and increase of the gold output of the Rand is to the people of South Africa, it is beyond that a vital factor in the progress of the whole civilized world. The board appointed under the Miners' Phthisis Act of 1912 has since the date of its appointment, August 1, 1912, up to January 31, 1913, dealt with 1653 applications, and there remained 783 applications awaiting investigation. In respect of the 1653 cases, applicants have been awarded £453,626, of which payments totalled £171,180. Financial circles are greatly concerned by the ever-increasing demand made on the mines by legislation, and the limit in that direction which the industry can bear has now been reached. The changes taking place on every mine in the personnel of its under-

ground employees are appalling, and it is probably no exaggeration to say that on average the whole personnel of the underground white labour of every mine changes twice each year, while there are cases on record where the number of changes is such that every four months an entirely new set of men have to run the property.

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the rise in prices is the increase in the supplies of gold, or as economists call it, the 'quantity theory of money.' This theory, which was propounded by Ricardo and popularized by John Stuart Mill, has been both supported and opposed by economists. Irving Fisher, for instance, rehabilitates the theory in his 'Purchasing Power of Money,' and J. L. Laughlin strenuously opposes it in his 'Principles of Money'; moreover, the chart of wholesale prices and the world's production of gold in W. T. Layton's 'Introduction to the Study of Prices' clearly shows that for relatively long periods there has been no conformity of the general trend of price fluctuation with gold production. Besides the increase in gold, there are many other factors to

be considered. To mention only a few: Fast emission of credit-money, trusts and combines, strikes, growth of population, rise in land-values, cost of armaments, revenue and social taxation, and the growing tendency to luxurious living. As Mr. Elkan is in a position to know, one cannot criticize his use of the word 'appalling' in connection with the ceaseless changing of employees, but one wonders if such an extraordinary state of things is either desirable or necessary. Certainly there does not seem to be much advantage in the practice from a monetary point of view, as it has been estimated that every change means an average loss of £10 to a company. The figures given for the huge electric plant which will be running next year point to the elimination of a picturesque feature, the smoke-stacks; and signs are not wanting that Rand students of engineering will in another decade only have as models for study in steam-engine practice the locomotives that pull the trains out of Park Station. The president-elect for 1913 is Mr. John Munro, the local representative of the Barnato interests.

Mine subsidence has gained some notoriety lately by holding up the traffic on the Geldenhuis-Simmer section of the railway, some seven miles east of Johannesburg. From 8 p.m. on February 28 to noon the next day, residents on the Geldenhuis Estate and adjoining properties were treated to a lively succession of rumblings and earth-tremors, which indicated the collapse of old workings underneath. The caving caused a subsidence of about one foot along a stretch of three hundred yards of the permanent way, and it also disturbed the Main Reef road, which at this point is some two hundred yards north of the line and nearer the centre of disturbance. Numerous cracks and fissures were also noticeable all over the affected area. The inconvenience caused was not very great, as the southern coal line was requisitioned, and the track was soon re-ballasted up to its old level. The occurrence is interesting, as it shows that the 'angle of fracture' swung much farther toward the dip than is usual. The bounding line of dislocation of overlying strata generally lies half-way between a vertical and a normal drawn from the point of collapse, but in this case it inclined toward the dip even beyond the normal. For this reason, although the worked-out stopes vertically under the line were all sand-filled or packed long ago, according to regulation requirements, it still, owing to the effect of 'draw,' suffered damage from caving, which took place a long way

from it laterally. The mining regulations are unscientific in respect of their provisions for protecting the surface, as they stipulate only for support vertically underneath, and do not call for support as a protection against 'draw.' This extra packing to the rise is, however, scarcely worth insisting upon at this stage of the Rand's history, as important surface works are in danger in such few places, and as in most of these areas settlement has already taken place. Experience with this particular stratum has shown that cavings occurring at depths over 1000 ft. are not likely to affect the surface to any material extent.

Premier Diamond.—The annual meeting of this company, which was held in February, was rendered interesting by the explanatory eloquence of the retiring commercial managing director, Mr. A. Wagner, who presided. He averred that he had been forced to resign, and he subjected the firm of Barnato Bros. to a severe criticism in connection therewith. He characterized the agitation for the representation of French interests as "one of the greatest farces this joyful community has ever lived through," and he went on to show how the group system of control annihilated every bit of individuality, and how baneful was the effect of direction by alternates for European directors who never meant to assume the responsibilities of their position on the spot. In addition to his moving swan-song, which compelled close attention, Mr. Wagner also gave an exhaustive review of the general affairs of the company. Mr. G. Imroth replied to the criticisms directed against the procedure adopted by Barnato Bros., by pointing out that the firm held a very considerable portion of the shares of the Premier company, and was, therefore, entitled to seats on the board proportionate in number to the shares held. He stated that in the matter of the representation desired by Mr. S. B. Joel, there had been no inconsistency "but simply an evolution of ideas, due entirely to changed circumstances."

The Premier Mine did very well in 1912, owing to the increased scale of operations and the steadily advancing price of diamonds. 9,707,098 loads were treated and 1,992,474 carats were recovered of a value of £2,004,943. The value per carat was £1. 0s. 1'5d.; and the cost per carat, 11s. 2'8d. The cost per load was 2s. 4'8d.; the value per load, 4s. 1'6d.; and the profit per load, 1s. 8'8d. The dividends amounted to £360,000 on a capital of £80,000. The yield of carats per load has been persistently falling ever since the mine started, but this has been counterbalanced by



HEAD-GEAR OF BRAKPAK'S SOUTH SHAFT.

the lowering of cost due to the greater quantity of blue ground treated and by the better price now being obtained for the gems. Costs, however, must inevitably rise as the mine becomes deeper, and the price of diamonds, always more or less a matter of caprice and fashion, may sustain a setback when least expected. It is difficult, therefore, to predict to what level the profits of this wonderful undertaking will rise or fall as the years roll on. At present the diamond market is booming, shareholders are happy, and everything is *couleur de rose*. It is perhaps significant that at the De Beers annual meeting in December there was a marked absence of adverse criticism in the references made by Mr. Francis Oats to the Premier company, and it was consequently thought that a working agreement had been entered into by these two powerful diamond-producing rivals. This inference is supported by the knowledge that the firm of Barnato Bros. has now acquired a very large interest in the Premier in addition to its great interests in the Diamond Syndicate, De Beers, and Jagersfontein.

The diamond output of the South African Union for 1912 was 5,071,882 carats, value £10,061,489. "All for the vanity of woman," as Mr. Rhodes once remarked—"and for the depravity of man!" as a lady thoughtfully added.

The Mine Managers' Association annual meeting was the occasion of a valedictory address by the president, Mr. R. C. Warriner, the general manager of the Crown Mines, which, though containing nothing remarkably novel, advanced at least one very useful idea. He pointed out that a machine-boy on handle-work only makes 2s. per shift, whereas a hammer-boy can easily drill 48 inches and make 3s. per shift, and that it is desirable to encourage the machine-boy by enabling him to earn as much as or more than a hammer-boy, as in times of labour stringency one naturally relies upon machines to save the situation. There is no doubt that the hammer-boy has had something in the nature of a soft snap ever since the goldfield started, and that it is now about time for him to take a back seat and give place to the more indispensable adjunct of the big-mill policy, the machine-boy. Even apart from this consideration, the machine-boy has a much more dangerous and generally a tougher time than the hammer-boy, and he on this account alone deserves a better reward than his more favoured brother. Mr. Warriner's allusion to "the most important feature of all being the

increased spirit of co-operation," is open to some slight criticism in view of the abstention of the Robinson group from the Native Labour Recruiting Corporation and the secession of the Robinson and the Central Mining-Rand Mines groups from that useful co-operative body, the Mines Trials Committee. There is no doubt, however, that the competition in native recruiting is now only a bad memory, thanks to the saner idea of unity more generally prevalent. The president further stated that, owing to effective measures, dust underground was now scarcely appreciable, and that, consequently, new cases of miner's phthisis should soon be of rare occurrence. It is sincerely to be hoped that this good news will speedily be verified by the absence of obituary notices, which draw attention to the phthisis danger, as parents still decline to believe that mining is a healthy trade, and they, therefore, apprentice their hopefuls to other professions offering better chances of enjoying a serene old age. He also drew attention to the indifference shown by indentured apprentices to the facilities afforded by the School of Mines to enable them to educate themselves in the scientific principles of their adopted trades. It is common knowledge that these youths are apt to have engagements elsewhere when the hour of the evening class arrives, but this evasion of duty is not peculiar to South Africa; it causes more concern here because of the advancing tide of competitive coloured labour. Mr. Warriner, after commenting on the increase of 8d. per ton in working cost as compared with the cost in 1911, paid a deserved tribute to the sympathetic assistance at all times rendered to the industry by the government mining engineer, R. N. Kotze, and concluded by drawing the attention of members to the bad attendances at the monthly meetings. If he had interpolated a well-known condemnatory modifier in front of the word 'bad,' his expression of opinion would have gained in force and lost none of its accuracy. The new president of the association is A. E. Payne, the manager of the Consolidated Langlaagte Mines.

The Bellevue Tins, an obscure tin mine in the bushveld, was the cause of one of those ripples of sunshiny merriment which sometimes brighten the dull atmosphere of the Union House of Assembly. The Minister of Mines, Mr. Malan, in reply to a question concerning the mine, said that the first prospectus was registered in the office of the Registrar of Companies, on November 19, 1911, and that this prospectus was subsequently withdrawn,

and another company with practically the same objects was registered on March 19, 1912, under an identical name as a private company. The present prospectus was, it was understood, marked 'private and confidential,' and as such was not a prospectus within the legal meaning of the expression. As regards the value of the property from a mineral point of view, at a recent visit by the Inspector of Mines no signs of tin or of typical tin-bearing rock were to be seen in the piles of samples or dumps. At the time of the same inspection it was found that no work had been done for a considerable period, and access could not have been obtained to the shaft. As regarded the number of persons employed at the date of the inspection, there was apparently one white man and one *umfaan*, but the former was absent (laughter). From the above crisp ministerial appraisal the productive contingencies of this concern should be easy to assess, and the amount of prospective dividends to be earned on the capital of £8000 by the exploitation of the lode should not be difficult to estimate. The absence of signs of tin or of tin ore in the piles of samples is a distinctly unfortunate deprivation in view of the fact that the property was floated for the purpose of winning that metal.

The Geological Survey Report for 1911 fully maintains the high standard of its predecessors. Both paper and type are good, and the photographs, maps, and sections are clear, artistic, and instructive; the flimsy art-green cover, however, might be improved upon, as it soon falls to pieces unless the volume is treated with more respect than it generally gets in a workaday mining world. During the year, 4588 square miles were surveyed, and 3144 miles of geological boundaries were traced. The field geologists covered 2268 miles by wagon and 9803 miles by riding, driving, and walking.

The director, Mr. H. Kynaston, deals in his report with the general scope of the work and with recent developments in the tin districts; he also elucidates the geology of a portion of the Rustenburg district. Mr. Mellor gives a well reasoned reading of the geology of the Lower Witwatersrand in the Central Rand, and advances common-sense solutions for various fiercely debated stratigraphical anomalies. Dr. Humphrey deals with the geology of the Pilandsberg, a mountainous area rich in plutonic and effusive rocks; he also gives a brief account of a traverse through parts of the Vryheid district and Zululand. The final

paper is a collaboration, edited by Mr. R. N. Kotze, dealing with the coal resources of South Africa. From it one learns that the annual production reaches the insignificant total of 7,000,000 tons, that the pit's-mouth price is only about 5s., which is as low as anywhere in the world (the price in Great Britain is 8s. 2d.) and that the present methods of exploitation permit of the winning of 55% of the coal available; the quality is very variable, the percentage of ash being from 6 to 30%, usually from 10 to 15%. The total coal resources are estimated at 55,200,000,000 tons, which is about one-third of the amount available in Great Britain, one-half that of Canada, and three times that of France, Belgium, or Russia. Coal in South Africa is practically a drug on the market, and competition is keen among producers. From the quantity available and the low cost of production, it would seem that the potentialities of the country in respect of fuel are immense, but it will be a long time before they are realized. The Curator reports that increased interest was shown in the museum collection and library by the general public, especially by those connected with mining and education; a large number of samples were submitted by the public, and 732 determinations of minerals and rock specimens were made for them. In addition to this volume, the price of which is 7s. 6d., various supplementary sheets of the geological map of the Transvaal with short explanatory memoirs were also published. The publications of this department are of great assistance to mining engineers, geologists, and educationists, and they might even have their sphere of usefulness greatly extended if the economic features and possibilities of the districts surveyed were given fuller prominence.

SAN FRANCISCO.

Interest in Alaska received a new impulse when the Alaskan Railroad Commission filed its report early in February. Coming as it did so near adjournment of Congress, it was hardly to be expected that any action would be taken immediately. The report received favourable attention from the President and in printed form is now widely available. In the meantime Mr. Wilson has succeeded Mr. Taft in the White House and strong efforts are being made to induce him to include the matter among those to be considered at the special session of Congress to assemble in April. Whether this be done or not, it is understood that the new administration will make determined efforts to find a basis of settlement of

various Alaska questions. In brief, the Commission recommends the immediate building of the railroad (1) to connect Chitna, the present terminus of the Copper River & North Western with Fairbanks and the Yukon Valley, and with a branch to the Bering river coal-fields; (2) to connect Seward with the Kuskoquim valley and the Matanuska coalfields. It is estimated that these lines can be built for \$35,000,000 and will include 733 miles of track. Estimates for alternative and supplementary lines are also given, but the Commission considers these two as of first importance. It is pointed out that if these roads be built with private capital, allowing a return of 6%, the rates must necessarily be so high that they will not effect the main thing to be accomplished, namely, the prompt development of the country. If, on the other hand, public money be used, at 3%, the estimated traffic will be ample to pay the operating and fixed charges and still the rates may be made low enough to stimulate industry. It is further shown that under present conditions of transport it is impossible to do more than gouge out the richest of the placers and to operate lode mines near the coast. With railroads it is believed that the country can be made as important and productive as Scandinavia. There is strong popular prejudice in the United States against government ownership of railroads and the outcome will be uncertain, but in any event this careful, scientific investigation of the actual conditions obtaining, has done much to clarify the situation.

Juneau in the meantime is the mecca of those who look to big things in quartz mining. The Alaska Juneau and Alaska Gold Mines are making steady progress with their long adits to the lodes in Silver Bow basin and are also going ahead with their treatment-plants. The Nugget creek power-plant has been completed and is furnishing power to the great Treadwell mines across the channel, though at this season reliance is mainly upon the excellent steam electric plant on Douglas island.

A summary of operations for January is given below as representative of the regular work.

Quartz Mining is also active far to the north at Fairbanks. In all, 16 small stamp-mills are now at work crushing ore ranging in value from \$20 to \$75 per ton. As yet operations are on a small scale, but if transport and fuel conditions can be improved an important industry seems likely to be developed. Typical of recent mill results may be mentioned a bar worth \$480 from 19 tons of ore from the Teddy R, with tailing losses estimated at \$6 per ton; a run at the Newsboy mill on ore from the Overgaard lease on Willow creek, showing the same value; a run in the same mill on Homestake ore showing a value of \$75 per ton and another at the Chena mill on Rainbow ore, showing a value of \$20 to \$30. These mills are all small, consisting of 2 to 5 stamps, and the veins are narrow. Development has not generally extended below 300 to 400 ft., but the work of the winter is none the less felt to be distinctly encouraging. J. L. Timmins is promoting and proposes to erect a power-plant at Tatlaneka, if sufficient consumption is guaranteed. The plant, if built, will have a capacity of 10,000 kw., and, while using water-power in summer, will burn coal in winter. Abundance of water-power and coal make the Tatlaneka a suitable site. The increasing number of small mills and the large amount of low-grade placer ground that could be worked with cheap power and supplies would seem to justify the erection of such a plant, especially if the proposed government railroad becomes a certainty.

Atlin, and indeed the whole Northwest, is excited over reported discoveries of rich placer ground in the Cassiar mountains east of Lake Teslin. Few facts are yet at hand, but enthusiastic men on the ground are sending out expensive telegrams about "pay-dirt running \$6 to the pan." A number of experienced Klondyke and Alaska prospectors have outfitted and started for the district; among others George Carmack, discoverer of the

RESULTS AT THE TREADWELL GROUP FOR JANUARY.

	Alaska Mexican.	Alaska Treadwell		Alaska United.	
				Ready Bullion.	700-ft. Claim.
Stamps working	120	210	300	120	120
Ore crushed, tons	19,908	32,648	38,752	17,920	19,393
Concentrate saved, tons	396	596	774	468	380
Yield from amalgamation	16,787	80,746		\$25,904	\$20,010
Yield from cyanidation	18,446	76,005		21,274	19,585
Total realizable value	35,079	155,184		46,707	39,199
Average value per ton milled	1.80	2.19		2.63	2.04
Operating expenses	25,074	84,104		24,529	24,325
Construction expenses	1,436	4,049		218	1,216
Estimated net profit	8,567	67,030		21,959	13,658

Klondyke, who puts his faith again in 'Skoom Jim,' the Indian vouching for the find.

Dredging in the Yukon was profitable last year according to the report of the Yukon Gold Co. for the year ended December 31, 1912. The output of this concern was worth \$1,863,445, working costs were \$2,142,029, and operating profits \$2,721,419. From these profits were deducted royalties \$692,995; amortization and deferred charges \$577,146, and interest, general expenses, and examinations, \$378,686. The company suffered a misfortune, however, when Dredge No. 1 on the Lower Bonanza creek was blown up by dynamite on February 24, at night. The charge was placed on the deck about midships. The explosion tore a hole about 8 by 20 ft. in the deck, destroyed 12 frames, housing tables, and save-all, but did comparatively little damage to machinery. The hull filled and sank. On pumping out the pond, only a small hole was found in the bottom of the hull, and few main timbers were injured. Abundant materials are on hand for repairs, which have since been started. It is expected that the dredge will be ready to start operation with the rest of the fleet. No motive for the act is known and the perpetrator has not yet been discovered.

In California dredging interests have been much disturbed by the proposal to restrict the companies to working of ground that can be shown to be non-agricultural in character. This is felt to be especially unjust in view of the large amount of good land ruined without protest by other industries and even by the farmers themselves. However, the amount of land attacked by the bill is not great. There are approximately 12,000 acres of land thought to be suitable for dredging in the state, and only about 3500 acres of this could be classified as agricultural. According to figures of the California Development Board, there are 28,000,000 acres of arable land in the state, and assuming 3500 acres as the area of such land planned to be dredged, it will be seen that this represents a minute fraction of the total arable land. The distribution of this agricultural land is approximately as follows: Butte county, 632 acres; Yuba, 792; Sacramento, 1372; Placer, 530 (not entirely proved to be dredging land); Trinity, 80; Stanislaus, 150; total 3556. Nearly one-half of the total agricultural land to be dredged is owned by one company, the Natomas Consolidated of California. This concern has, according to the management, over \$3,000,000 invested in dredges, shops, and plant, aside from the investment in land. It employs nearly 400 men

in the operation and maintenance of its dredges, and produces about \$2,000,000 yearly. The company in its different operations employs a total of 1500 men and has a yearly pay-roll of about \$1,200,000. It is at the same time engaged in extensive land-reclamation schemes and is, in fact, bringing into cultivation 40 acres for every one destroyed in dredging.



A Hydraulic Giant at work.

Dredging men elsewhere are having hard luck in several ways. The Pato dredge in Colombia went to the bottom in February, but was little damaged and was only out of commission a couple of weeks. The cause of the accident has not been made known. In the Philippines, starting of the Gumas dredge was made a great function last autumn. It has evidently been successful; at least, the company has paid two monthly 10% dividends and enough amalgam evidently formed on the tables to attract thieves, since robbery of the dredge was one of the most exciting of recent happenings on the Paracale. Especial interest attaches to this boat, since it is the first American type dredge in the district and is working

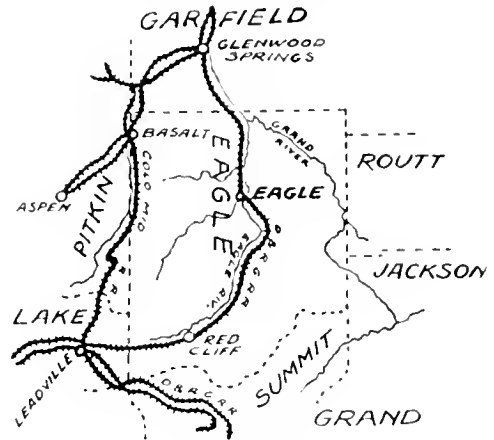
side by side with several lighter New Zealand boats. Interesting comparisons would seem to be in prospect. There are now four dredges on the Paracale; two are to be started in April and two more are expected to be built. Things are a bit quiet in the Islands now, but the Colorado mill is reported to have cleaned up 100,000 pesos in December.

Petroleum production in California continues large but runs evenly. In January the output was 7,566,789 bbl., practically the same as the year before. The surplus on February 1 was estimated at 47,557,000 bbl. February dividends amounted to \$542,440. Land titles are still unsettled and various suits between the Government, Southern Pacific, and private claimants are dragging through the courts. What the new administration may intend (also what it may be able to accomplish) in the way of a better oil-land law, is as yet unknown. The Southern Pacific and Santa Fe are to join in building a pipe-line over Tehachapi pass to relieve congestion on the railroad line, which the two systems use jointly. General Petroleum has begun to receive oil for its new system of pipe-lines. It is said that a new group of oil-men is forming to rival the Associated and General Petroleum. Among those given as interested are John Martin, Ralph Arnold, Frank L. Brown, W. G. Clark, and H. C. Hoover. It goes without saying that such men would be able to build up a big company if they went at it in earnest, but no detailed announcement of plans has yet been made.

Quicksilver mining has attracted renewed attention in the last ten years and there has been a noticeable disposition to take hold of new and old properties. Last year was not as satisfactory to the industry as in 1911, the average price being \$41.58 per flask as against \$47.58. None the less, quicksilver mining is important and changes in the industry have been marked. For many years the sale of quicksilver in the United States was closely controlled, but in 1911 the combination of producers was broken up, with the unusual immediate effect of an increase in price. The succeeding decrease in 1912 has been felt more particularly by the larger companies and dissatisfaction is strong among stockholders in the Quicksilver Mining Co., owning the famous New Almaden mine near San José, California. This mine has still the record for the largest aggregate production in the United States. At a stormy special meeting of the stockholders held in New York, February 15, the president of the company, Charles A. Nones, was requested to resign and a com-

mittee of the stockholders was appointed to examine the accounts of the company and appraise the property. This committee is to report on April 8. Mr. Nones refused to resign and professes willingness to undergo most rigid examination. He is charged with speculating in the stock of the company and so managing the property that no one received any return except the salaried officers. Incidentally the fact was developed that the books of the company are now in the hands of the Department of Justice for investigation, presumably in connection with the anti-trust prosecutions. As Mr. Nones was a prominent factor in the old selling agency, the investigation is likely to determine the facts as to ugly rumours that have long been current to the effect that mercury belonging to outsiders was only sold while prices were low while that of the insiders found a ready market when it was high.

Colorado mining men and engineers have an excitement all their own in a new discovery of silver ore at Eagle. This is on the main



Part of Colorado.

line of the Denver & Rio Grande between Leadville and Glenwood Springs and has been passed and repassed by engineers and prospectors. The explanation of the failure to find the ore earlier lies as usual in the fact that the mode of occurrence is new. The country rock is sandstone, apparently the equivalent in age of the vanadium-bearing sandstones of southwestern Colorado. The silver occurs at least in part as chloride, but since 1% and over of vanadium is present a new mineral is suspected. The brown stains on the rock, now known to mark the presence of silver, have been taken for oil seepages. There are diabase dikes in the vicinity, but their relation to

the ores has not been determined. The whole country is as yet heavily covered with snow, which causes the sceptical to remark that such is usually the case when high-grade ore is found. That a real discovery has been made, however, seems certain. We can only hope that it may prove, as is claimed in Colorado, that a mining district is discovered in that state every decade. There has also been a discovery of rich gold ore near Platoro in Conejos county. It is said the gold occurs as a telluride, and visions of a second Cripple Creek dance before the eyes of the men developing

"my lady's maid couldn't miss." The firing began early each morning and a steady eight hours' work was kept up, but at night it was only occasionally that some battery, finding the night long and monotonous, decided to enliven it with a few rounds. Although enough ammunition was expended to exterminate a nation, the number of dead probably does not exceed 3000, and, without doubt, most of these were non-combatants. The leadership of the Federals was almost non-existent. The soldiers rose from the streets cold and hungry with evidently one idea: to shoot at something



ARTILLERY IN THE STREET.

the find. Just how important it really is, is not yet known.

MEXICO.

The Bombardment.—With a well armed force strongly entrenched in the centre of Mexico City and a large proportion of the Mexican army from half-a-dozen points trying to dislodge that force, the inhabitants have had everything to complain of but dullness. The effect of this most amazing affair, which has at least established the precedent that a city can be bombarded for eight days without previous warning, is shown in the shattered houses on a wide margin of the various lines of fire. The artillery work of the Diaz party was less comic than that of the Federals, who only hit what they aimed at on occasions when

or somebody as long as their ammunition lasted. As they were well supplied, the cartridge cases in the streets were like autumn leaves. The sharpshooters on the roofs allowed themselves occasional outbreaks of humour such as sniping a woman or two, and in one authenticated case, a child. One hero used his country's powder on a fox-terrier, who yelped and danced angrily as the bullets cut the dust around him. On one morning a troop of *rurales* rode in from the country and wandered down the streets of the foreign colony. Being asked to which side they belonged, the leader said "*Quien sabe.*" At the end of the street they were met with a blast of firing and two of the men tumbled from their saddles. The troop returned evidently grieved at their unpopularity in that quarter and decided to

camp where they were. As the inhabitants kept them supplied with food, they treated the surrounding uproar with indifference. There was little danger of looting, as the component parts of a mob were doing their best to hide from the storms of lead that swept the streets. The wounded for the most part stayed where they fell; the dead, during the badly observed armistices, were drenched with kerosene and left to smoulder in the streets.

The death of Madero, his brother, and the Vice-President was inevitable shortly after their capture; and it was only a question as to what excuse would be supplied. There would have been no rest for the country had Madero lived. Certain English newspapers have been sentimental over the death of these men, who have managed to steep the country in blood and ruin, but perhaps if they understood the meaning of the telegrams that Madero sent to the governors of various states when he felt his enemies gaining, advising that the American marines had landed in Vera Cruz, they would have less regret. It meant a hint to stir up the mob against the Americans, and this would have included all foreigners. His reputed noble ideals, which made him pardon the lowest bandits, did not prevent him from making a long list of men who were to die at the first opportunity: notably the patriotic and disinterested De la Barra, who was forced to take refuge in the British embassy. Now that the country has a soldier for a President and the heartfelt sympathy of the better class is with the change of affairs, it can be said that Mexico has gained a solution of its difficulties. But of honour or glory, not a jot.

The Future.—There is still a lot of work to do to convince the bandit element that their game is played out. The state of Morelos is to the fore again with bloodthirsty attacks, and soldiers are being sent to see about it. The state of Sonora is also up in arms, but the people will find a sterner reception than during the past two years, when they were engaged with an army that was never in sympathy with Madero. To every country its own methods. It is possible that the bandits may be recruited as *rurales* in the fashion of Porfirio Diaz, and the leaders may get official posts, instead of a decent gallows, but that they will be quieted somehow is fairly certain. The people have tried two years of the blessings of liberty: they can now wipe up the blood and go back to the only form of government that suits them. To give the new party justice, they may gradually improve on the rigorous dictatorship of the elder Diaz.

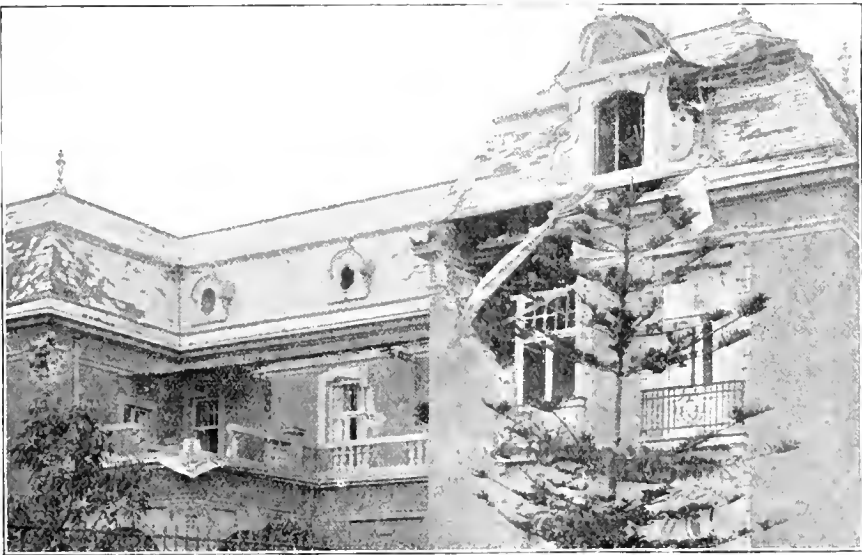
This can be called the only good resulting from Madero's overthrow of the Diaz regime. But as Sam Weller said of the schoolboy who learned the alphabet: "Is it worth going through so much to learn so little?"

Prospects for Mining.—Many people are prophesying a boom in mining affairs. Considering the long wait of two years during which capital has been warned from the country, it is not improbable that a revival will ensue, now that there is a good promise of peace. It is reported that the La Blanca y Anexas has been securing options on mines in the Pachuca district and taking advantage of the low terms asked during the troublous times. This company has taken up the option on the Cinco Señores mine, which adjoins their ground, and is now paying the purchase price in monthly instalments of 10,000 pesos. The mill will be increased to a capacity of 15,000 tons monthly. The Goerz Co. of South Africa is just finishing the installation of a 30-stamp mill at the La Fé mine, near the town of Zacatecas. This is expected to commence crushing by the end of June. The mine has an enormous tonnage of low-grade ore containing about 2% lead with some gold and silver. The mill will have a capacity of 300 tons daily, and it is a good specimen of the application of modern ideas to this class of work. It is a steel frame throughout with adobe walls, and can be considered fireproof. Owing to the character of the ore, a system of table concentration will be applied to eliminate the lead before cyanidation. The new Paterson vats will be used instead of the regular Pachuca. The Paterson is provided with a centrifugal pump instead of compressed-air-agitation. In Chihuahua and Sinaloa various small companies have been developing under adverse circumstances during the past year or two, and now that the horizon looks brighter, it is probable that there may be some good mines on the market in those states.

Taxco.—The Exploration Co., of London, has lately taken an option on the Espiritu Santo silver mine in the Taxco district, Guerrero. [This statement is contradicted at the head office in London. We are informed that the Exploration Company intends to make no further commitments in Mexico until it is apparent that law and order have been restored. At present railway transport is paralysed.—EDITOR.] This is practically the oldest mining district in Mexico, and the El Rey adit, which was driven to cut the vein system in depth, is reported to have been started by Herman Cortez. For more than 40 years the



THE WALLS OF THE NUEVA ERA OFFICE AFTER THE BOMBARDMENT.



AFTER THE RECENT BOMBARDMENT IN MEXICO.

district has been delivered over to *buscones*, who searched for high grade ore, and little systematic work has been done, except that of the Taxco Mines of Mexico, a London syndicate which developed some claims to the south of the Espiritu Santo, but closed-down a year ago owing to revolutionary troubles. Two main veins on the latter property join at certain points to form large lenses, the ore of which has been fairly thoroughly stoped as far as the old workers could go. Huge chambers are left without support, as the hard slate stands well even after centuries of excavation. The lower parts are packed with what was then considered low-grade material, or ore too rebellious for ancient methods of treatment. The reason given for the general abandonment of the district is that the ore in depth had a high zinc content, but it is believed that proper development both above and below the present lowest workings of the mine, would give a large tonnage that could be cyanided after concentrating the zinc or lead. Adjoining this mine to the north is the Pedregal, the deepest mine in the district and one that has also had a famous past history. It is reported that recent work of unwatering the shaft and exploring the old workings has shown the ore to continue below and with little zinc content. Tests on the Pedregal ore have shown a fairly high consumption of cyanide. The mines are all close to the town of Taxco, which is 20 miles from the Cuernavaca branch of the National railway.

TORONTO.

Porcupine.—The strike of miners, which began in November last, is over, although there are still a large number of men out, and frequent affrays between the strikers and non-unionists are reported. The official statement of the Hollinger, sent out with the February dividend cheques, was of a most reassuring character, showing a new high record of production, the output for the last two weeks being \$65,005 and \$59,313, respectively, as compared with \$51,769 for the week before the strike. The results of underground development have also been satisfactory. On the 300-ft. level two parallel drifts 35 ft. apart are being run south, and the gold content of the ore has been gradually increasing until it now runs from \$16 to \$23 per ton. The Dome will greatly enlarge its stamp capacity; to what extent will depend on further development. Either 40 or 60 additional stamps will be installed. The installation of the first slime-press gives the present mill a crushing capa-

city of 450 tons per day, at which rate of consumption there is seven years' supply of ore assured. The first clean-up has been made at the McEnaney 5-stamp mill, which is now earning \$500 per day treating 10 tons per stamp. The drift on the 200 ft. level has been opened up for 600 ft., practically all in ore. In the south face there is a remarkably good showing of 5 or 6 ft. of ore averaging \$40 to the ton. R. W. Stevenson, managing director of the Pearl Lake, reports a marked increase of gold in the vein at the 600-ft. level, a mill test of 300 tons showing \$35 per ton. The shaft is being put down to the 1000-ft. level. It is hoped to have the mill of 250-ton capacity, with equipment for cyanide treatment, in operation by August 1. Work at the Jupiter, which has been suspended since the strike, has been resumed with a small force. A rise is being made from the 300-ft. to the 200-ft. level, and the shaft will be sunk to 500 ft. The Swastika stamp-mill has started operations with enough ore to keep it running for 18 months at least.

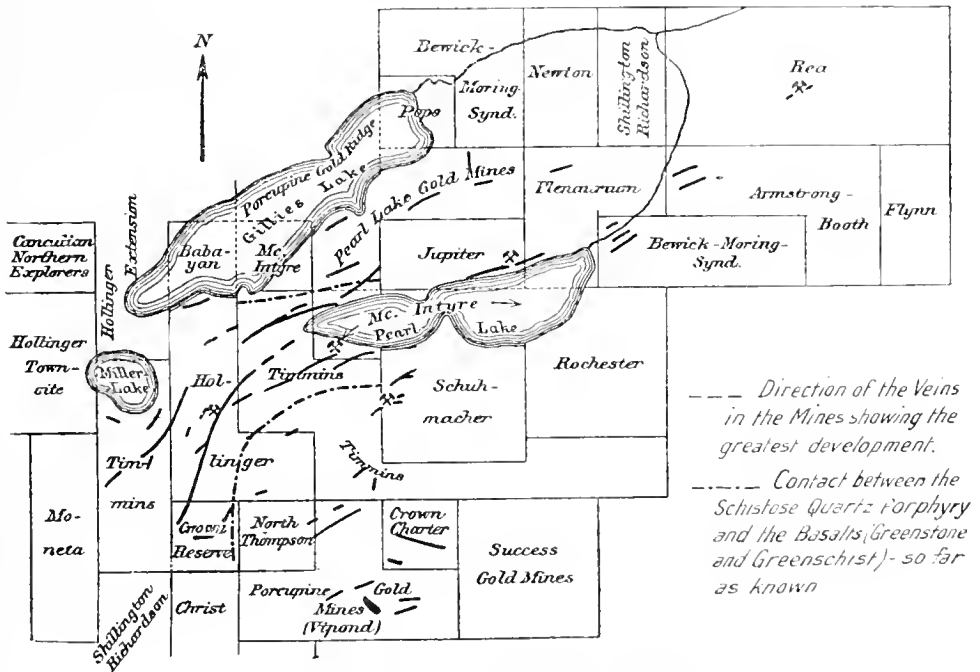
Cobalt.—Latterly there has been a great increase in British investments in this district, and several properties that were regarded as being exhausted or of doubtful value have been picked up by English syndicates. The owners of many other mines or prospects have been approached on behalf of British purchasers. The success of the English companies controlling the Cobalt Townsite and the Casey Cobalt, both of which were regarded as well-nigh hopeless under the former owners, has doubtless inspired this movement. The last company to be taken over was the City of Cobalt, for which the purchasing syndicate paid 52½ c. per share, but legal proceedings have been set on foot by a shareholder to set aside the sale. The La Rose has declared its regular quarterly dividend of 2½%, but withheld the anticipated bonus of 2½%, which was given last quarter. The February statement showed ore production of 230,102 oz., valued at \$136,182, as against 219,977 oz. valued at \$134,724, in January. The cash balance on hand at the end of the month was \$1,425,836. A strike of high-grade ore has been made on the 115-ft. level of vein No. 8 on the Lawson property. At the Nipissing a good ore-shoot has been developed on the Little Silver vein, one of the first to be worked in the camp, about 75 ft. below the old open-cut. The new low-grade mill is running to capacity, treating over 200 tons per day. Ore of an estimated net value of \$200,738 was mined during February. The regular quarterly dividend of 5% with a

2½% bonus has been declared. The ore reserves of the McKinley-Darragh at the end of 1912 were estimated at 5,368,500 oz. Though 2,717,383 oz. was extracted during the year the reserve is still within 200,000 oz. of the previous year's estimate. The total net profits for the year were \$1,153,848. In addition to the 3% quarterly dividend, a 7% bonus has been declared. The Peterson Lake will sink a shaft near the junction of Cart and Peterson lakes in the conglomerate area, which has been but little explored. The Penn-Canadian has cut the Big Pete vein on the fifth level, where it shows 2 to 3 inches of high-grade ore, with mill stuff on each side. This vein yielded well on the upper levels. The Beaver mill is treating 100 tons

tions. The average value of the ore treated was \$27.76 per ton, and the approximate extraction 97%. Milling costs were \$1.49 per ton, and alteration charges 20 c. per ton, making a total cost of \$1.69.

A movement is on foot to obtain control of the Peterson Lake of Cobalt on behalf of an English syndicate. The shareholders are asked at what price they will sell, provided the stock is taken within 40 days.

The court has set aside the sale of the City of Cobalt mine to an English syndicate for \$750,000, or 5½ c. per share, on the ground that \$900,000 had been offered by another purchaser, and has ordered the amount of \$10,000 paid on the option to be returned.



THE PEARL LAKE DISTRICT, PORCUPINE.

per day. A cross-cut is being run to pick up the main vein on the 700-ft. level. The Wettlaufer, the only successful mine in the South Lorrain district, has passed its usual dividend. The Bartlett, in the Gowganda district, has been acquired by the Scottish Nigeria Mining Co., and development is being pushed with A. M. Wylie in charge.

Later.—The latest statement sent out by the Hollinger gives the profits for the 8 weeks from January 1 to February 25 as \$241,600. For the last half of this period the mill treated 9240 tons, or an average of 330 tons per day. Alterations interfered somewhat with opera-

CAMBORNE.

East Pool.—The conversion of this old cost-book company into one of limited liability has now been accomplished, the new company having a capital of £100,000, and a subscribed working capital of over £30,000. A steady output of 40 tons of black tin per month is being maintained. There is at present no marked improvement in the grade of the ore milled, but the property is being vigorously developed by rock-drill and hand-labour, so the outlook is more hopeful. The general managers (Bewick, Moring & Co.) have decided to instal an electrical belt-driven ten-drill

compressor and also a dull-sharpening machine.

Wheal Peavor. The 70-inch Cornish pumping-engine has been erected at this mine near Redruth, and the installation of the pit-work is nearing completion. Difficulty has been experienced in clearing the County adit-level, owing to the wet season, but the largest portion has been put in good condition. This work is of first importance. Ten stamps have already started work on dump stuff.

Killifreth. It has been decided to instal an 85-in. Cornish pumping-engine on this mine east of Redruth, which is inclined to be wet. In the previous working, an 80-inch engine was erected on Hawke's shaft a few years before the stoppage, and it proved equal to dealing with the water, so that an 85-inch engine, assisted by water-skips, provides a margin of safety. For some time, the work of clearing the County adit, a branch of which runs through this property, has been in hand, and also the re-collaring of Hawke's engine shaft.

Condurrow.—For the second time this company, working the mine south of Camborne, is faced with re-construction, its share capital and also the funds provided by the Lebutures being exhausted. Already over £60,000 has been spent on the property, but little has been actually spent on development; indeed the stage for proving the value of the property has only now been reached. It is unfortunate that, at this stage, acute differences have arisen between the chairman and the other members of the board, the result being that a scheme of re-construction (by which four shares of 5s. each in a new company, credited 3s. 6d. paid, were offered for each three shares at present held) was defeated, even though £15,000 was guaranteed. It was felt that the terms of the underwriters were too severe, but to underwrite any scheme for a mine in the position of Condurrow is certain to be a costly business. It is the duty of the chairman, having successfully opposed the scheme recommended by his colleagues, to make the next move.

West Kitty.—Bad luck has been the portion lately of those in control of this property at St. Agnes. One mishap after another has occurred to the pumping machinery in Friendly shaft, and these have been all the more annoying, inasmuch as there is a fine lode in the bottom of this section, which has now been covered by water for some months. Without ore from this lode the sales of black tin have fallen from 7 to 4½ tons per fortnight, and the result must be heavy losses to the shareholders. It

is a great pity that further capital cannot be found to adequately develop this range of mines, for the outlay would probably prove profitable. The liquidation, now in its third year, is still not completed, nor do the shareholders receive any official information of what is going on at the mine. It is a mistake to preserve silence when the mine is doing badly and only keep the shareholders informed when there is good news to communicate.

Wheal Coates.—This mine on St. Agnes beacon is now in fork; ore is being mined, and crushed at a battery of 20 Cornish stamps in the Chapel Porth valley. This arrangement is only temporary, until the completion of the erection of the 10 modern stamps, driven by a gas engine, now being erected on the property.

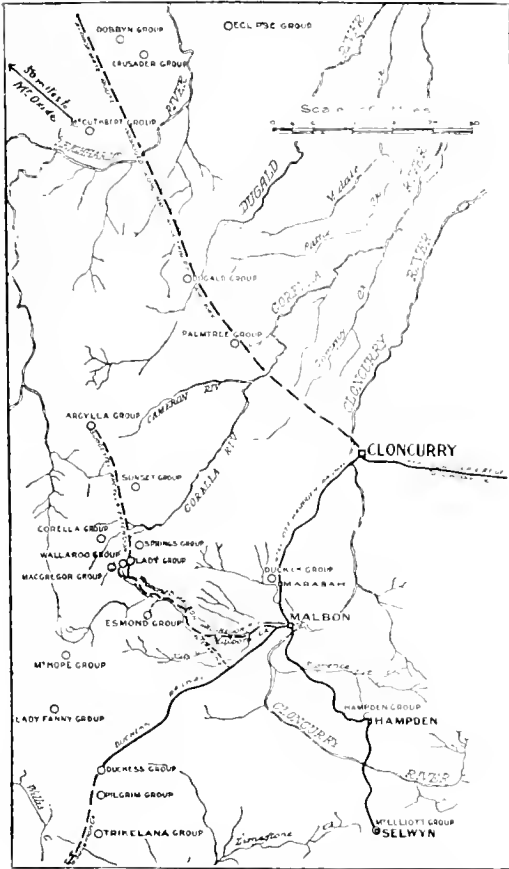
MELBOURNE.

Labour and Government.—The position of affairs in the Australian Commonwealth is clouded by the financial outlook. The Federal elections take place within the next three months, and the question of all importance to the investing public, both in industrial concerns and in mines, is whether the Labour Party is to be returned to power. It is no use disguising the fact that to a large section of the community here, the Labour Party appeals most strongly. That section embraces the whole of those who may be termed the working classes. The reason of this is that the party, by means of Wages Boards and the Federal Arbitration Court, has sought to demonstrate to every worker in the community that his or her salvation lies through the medium of the legislature. The first thing that was done was to get Unionism recognized by the Federal Arbitration Court. The State legislators have not gone that far. Quite recently Mr. Justice Higgins, whose leanings are toward the so-called oppressed workmen, recognized the principle of preference to Unionists at Brisbane. Later still the Federal Government has appointed two members to the High Court. Their future career will be watched with the utmost interest. If these two new justices should side with Justices Isaacs and Higgins, the expectation is that the old ideas of the justices of a court accepting precedent as a guidance for future decisions will come to an end. The whole of the Australian community, as a consequence of legal trouble and Parliamentary truckling, is seething with unrest. At Broken Hill for instance, quite recently the policy of the Unionists (who comprise about 90% of the workers) that

they will not work with non-unionists, has been brought up as a fighting platform. In Port Pirie, where the Broken Hill Proprietary Company has been wanting labour for some time past, there has been an influx of Russian and other foreign labour attracted by the high wages offered by the company. To meet this competition, some of the Unionist leaders are protesting against the incoming of men who will form and will support secret societies, presumably of the Mafia type. While these

drought, the State ought to assist them with seed wheat. They think that the Treasury ought to give them the cheapest of cheap freights for their products, that it ought to market their goods, and above all that it ought to build railways and roads and lay down trams to their doors. The public servants look for higher salaries. The workers on public works want big wages and easy supervision, and railway officials want 8 hours and a high minimum wage, while bank clerks and typewriters require, and have been given, fat minimum wages and definite weekly working terms. The Labour Party, therefore, goes to the polls promising the masses further benefits, while the Liberal Party simply goes with the policy of negation. These matters are discussed here for the simple reason that they are going to affect trade and industry to the very core during the next three years, no matter what party is in power. The banks have lent to the full extent of their capacity, and now, with harder times, they are restricting accommodation. Every state is a borrower, not so much for wasteful expenditure as for progressive works. But almost every industry today is alarmed at the labour outlook.

Queensland.—Mining in North Queensland is going ahead fairly steadily. The Hampden company has made its appearance on the dividend list with the disbursement of 4s. out of profits. It has acquired and paid for the MacGregor mine, in which reserves estimated to contain 8000 tons of copper are known to exist. The Duchess mine is developing fairly well, but the most interesting news from the district is that at a depth of 412 ft. at the No. 1 shaft of the Hampden mine, over 6½ ft. of pyrite has been cut. A strike of pyritic ore in the Hampden mine would immensely benefit the company, and developments at this point are worthy of the closest attention. W. H. Corbould (general manager for the Mount Elliott company) has returned to Queensland. The fire in the Hampden South Consols mine has occasioned some anxiety among investors. It is reported that in the No. 5 level of the Mount Elliott mine some good sulphides have been found. Statements are also current that the company may obtain some new properties, and people are agog for information. So far as actual mining goes, the most important development that has taken place has been in connection with the Mount Cuthbert mine, where a splendid body of ore has been found at 150 ft. in the Kalkadoon lease of that com-



The Cloncurry Copper District, North Queensland.

protests are being heard, the financial pressure in the states is curtailing employment in all directions. The result of this is that the worker will soon have to make up his mind whether he shall permit the law of supply and demand to operate. The worst of all this is that the seeds sown by our politicians, not only in the ranks of labour, but in the Liberal Party, have been such as to produce all kinds of economic weeds. The whole community has been more or less debauched by our legislators. Farmers believe that if they get a

pany. Mr. Corbould is now the consulting engineer to this company. At Mt. Oxide development work is progressing most satisfactorily. W. A. Mercer, who arranged the purchase of this mine on behalf of the Consolidated Gold Fields, is still in Victoria, where he has been investigating the progress of work at the Toora tin mines, a property in which he is interested, situated in Southern Gippsland.

Prospecting work is reviving, as the result of the harder times. A good deal of attention is still being devoted to the northern territories, and one company having a large copper formation is being assisted by the Federal government to open it up to depth. A scheme is also under way for testing a portion of the western part of the state for oil, and several tin mining enterprises are being watched by financial people. On the Gulf of Carpentaria two or three copper formations are in process of development. It will be seen, therefore, that while the gold mining industry of most of the states is lacking a stimulant, a good deal of attention is being paid to the industrial metals.

Broken Hill.—In connection with labour, it is interesting to remember that the Broken Hill Proprietary company has decided to go into the enterprise of iron and steel manufacture. An outline of this scheme has already been given in these columns. That there is an opening for the company is shown by the extent of the imports of various kinds of iron and steel into the Commonwealth during the past few years. It must not be overlooked that the trade which the Proprietary company proposes to acquire is now divided between American, British, and German manufacturers. These certainly are not likely to allow the Proprietary an easy entry into their field of operations. While this is the case, it can be said at once that the whole spirit of the community is with the Proprietary company in the scheme on which it is embarking. The feeling exists everywhere that in these days of war alarms the country that is not self-contained in the matter of manufacture of iron and steel is not in a state of defence. Therefore, it can be said with the utmost confidence that if the Proprietary company should find dumping of any kind attempted, whether from India, China, Germany, the United States, or Great Britain, the Legislature will act to protect it against the invader. Sentiment is one of the strongest factors in the world, and it is that factor that will operate here for Australia as against

the foreigner. The Proprietary company recently published its half-yearly statement of accounts. When doing this, it lifted the veil a good deal more than is usual. In the first place it disclosed that the ore reserve in the mine at Broken Hill has shrunk to 2,000,000 tons. Taking the output at 200,000 tons per annum, working two shifts, this would give a 10 years' life. Then the amount of zinc tailing in the dumps is 1,150,000 tons. Taking the quantity handled per annum at 190,000 tons, it can easily be seen that the life of these dumps is 6 years. Here, no one imagines that the Proprietary company, so far as its silver-lead goes, has a life of more than 7 years. At Port Pirie, the company has large dumps of zinc slags. These no doubt will be worked for the zinc content, and with the iron resources at the disposal of the company will help to make up a big industrial concern. At the same time, taking the balance-sheet as a whole, the figures are disappointing, although it is probable that some substantial writing-down has taken place.

Concurrently with the issue of the Proprietary report is that of the South Broken Hill company. The figures submitted show that the company has benefited so greatly by the enhanced price of lead and zinc as to be able to publish a record statement of profits. The mine certainly is the greatest at Broken Hill, and it is the one to which Australian investors cling with the greatest tenacity. The most interesting feature about the property is that during the past half-year sulphides of a grade of below 14% lead were worked, also that the large sum of £76,000 was obtained by the company under its contract with the Amalgamated Zinc (De Bavay's) and the Zinc Corporation, under which the latter companies treats the zinc tailing from the South mine. At the meeting of the company, F. C. Howard (managing director) who recently visited Europe, was able to say that the result of his trip would be for the benefit of the company, but he did not disclose what was in the air. It speaks volumes for Mr. Howard's personality that he was allowed to get off so lightly. It may be added that the work in the South end of the mine toward the South Blocks company's lease is proving the existence of shoots of ore that the company never expected. This fact, together with the ore that is pitching into the property at the north end from the Central mine, justifies the statement already made that the South Broken Hill mine is without doubt the greatest of the group of Barrier companies.

PERSONAL

ROBERT ALLEN has returned from Johannesburg.

CHARLES A. BANKS has been paying a short visit to London from British Columbia.

A. CHESTER BEATTY is expected in London on May 1.

H. C. BELLINGER sailed on April 12 to New York, on his return to Australia.

S. H. BORIGHT, manager of the Lonely mine, sailed for Canada on April 11, on a holiday before returning to Rhodesia.

CYRIL BRACKENBURY left on March 29 for the Victoria nickel mine, Sudbury, Ontario.

FRANCIS P. BRAY left London on April 4 on a tour of inspection in Australia.

H. S. DENNY sailed for Mexico on April 5, accompanying DR. HANS SAUER.

LUDWIG H. DIEHL sailed on March 18 for Australia, on a tour round the world.

CLEMENT DIXON has been appointed consulting engineer to the Susanna Mines, Rhodesia.

J. S. DOUGLAS has been appointed manager of the Cananea copper mine, L. D. Ricketts continuing as consulting engineer.

COLIN FERGUSON, of the Randfontein, is in London.

GEORGE H. FOSTER is home from Broken Hill.

F. LYNWOOD GARRISON is returning to New York from Colombia.

E. R. GEORGE is in Spain, for John Taylor & Sons.

W. H. GOODCHILD has returned from Rhodesia.

ANDRE P. GRIFFITHS leaves London for Mexico on April 15.

J. POWELL HARDING, now with the Consolidated Langlaagte mines, is expected in London in May.

JAMES HEBBARD has been elected president of the Australasian Institute.

C. N. HENROTIN, now with the Tanganyika Concessions, has severed his connection with the Canadian Copper Co. in Ontario.

A. B. W. HODGES, on the termination of his contract as general manager, has returned from Cerro de Pasco to the United States.

H. C. HOOVER has left for New York.

THEODORE J. HOOVER has returned from the United States.

C. BARING HORWOOD was appointed consulting engineer to S. Neumann & Co. in November last.

E. D. ISAACSON has returned from the Congo.

CHARLES JANIN, from San Francisco, is in London.

A. M. MACKILLIGIN has left for West Africa. He will be back early in June.

JOHN McDERMOTT has been appointed manager of the Cam & Motor mines.

F. H. MORLEY, of Denver, arrived from Paris on April 11.

JOHN MUNRO is the new president of the Transvaal Chamber of Mines.

CHARLES OLDEN has gone to Chota Nagpur, India.

MAURICE PERCEVAL has returned to England from Naraguta, Northern Nigeria.

JOSEPH RALPH sailed on March 22 for New York, on his way to Salt Lake.

CHARLES RHODES left New Zealand for London on April 11.

J. B. RICHARDSON leaves on April 23 to take a post at the Frontino & Bolivia mines, in Colombia.

J. HENRY RICKARD sailed for Northern Nigeria on April 9.

T. A. RICKARD will lecture on the valuation of mines at the Sir John Cass Institute on April 24.

JOHN SAMPSON has resigned as manager of the British Broken Hill mine, feeling the need of a lengthy holiday after the injuries received from the explosion in December last.

W. H. SHOCKLEY is at Palo Alto, California.

W. EVAN SIMPSON leaves on April 23 for Toluca, Mexico.

G. HILDICK SMITH is expected from Johannesburg in May.

C. W. PURINGTON will lecture on the sampling of gravel deposits at the Sir John Cass Institute on May 1.

JUDD STEWART passed through London on his return from Chile to New York.

TWITE & STEINHART have been appointed consulting engineers to the Saxon Tin & Wolfram Mining Company.

C. A. VAUX has returned from Northern Siberia.

D'ARCY WEATHERBE, of Bainbridge, Seymour & Co., has returned to England from South America.

H. E. WEST has gone to India as a cyanide expert, in the service of John Taylor & Sons.

H. B. WILLIAMS is superintendent for the Sudan Gold Field, in Egypt.

HORACE V. WINCHELL is at Buenos Aires.

ERNEST R. WOAKES has gone on an inspection to Southern Rhodesia.

ARTHUR YATES is home from Sumatra.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Do Diamonds Grow ?

The Editor :

Sir — It is a common belief among the native diamond miners in India that if the tailing heaps of the diamond workings be left undisturbed for a period of about fifteen years, it will be found that a fresh crop of diamonds will have grown in the waste blue ground and that successive crops can be had from the same tailing at intervals of about the same length of time.

Dr. Max Bauer, in his work on precious stones, says that the same belief prevails among the South African diamond miners, but whether it is the Kaffir miners or the Europeans who have this belief, he does not specify.

That diamonds are found in the tailing of the blue ground is generally recognized, but it is thought that weathering action has disintegrated small lumps of matrix in the tailing and exposed the enclosed diamonds; but, as I will presently show in one instance that I know of, the blue ground is reduced to a fine mud that would run through a thirty-mesh screen, and this mud, it is said, has been worked over and over again for hundreds of years and has always yielded a crop of small diamond crystals.

Modern research has shown that with the diamonds recovered from the grease tables there are a very large number of microscopic diamond crystals. It is also known that if the blue ground of the South African mines be heated to a sufficiently high temperature it is capable of dissolving diamonds.

If then it is possible that the blue ground in its heated state dissolves the diamond, may it not be that the same matrix when disintegrated by the weather and subjected to segregative action reproduces the diamonds it is known to contain? We see this segregative action at work every day in the production of limestone, limonite, manganese ores, chrome, &c., from complex rocks of which these minerals form a part, but which can only be separately recognized when segregation has done its work. Indeed, it may be said that all the metals and most of the simple minerals now obtainable on the surface of the earth are due to segregative action.

It is generally allowed that 'kimberlite' or

blue ground is the original matrix of the diamond, and that there the crystals of diamonds have their genesis. The fact that portions of the same crystals have been found separated by intervals of blue ground is believed to prove that kimberlite is not the original matrix. This is easily accounted for when it is known that the blue ground filling the diamantiferous pipes is made up of successive outbursts of volcanic mud.

In the Kimberley mines the blue ground is said to be divided into 15 different columns, differing in colour, composition, contained minerals, and richness in diamonds, showing that each of these vertical layers was injected at different times, so that filling of the pipe was due to a long continued period of volcanic activity. As a proof of the segregative theory to account for the growth of the diamond crystal, it may be mentioned that not only have pieces of gold leaf, silica, and other extraneous matter been found enclosed within the diamond, but that after a crystal of fair size has been formed this may be coated with a layer of calcareous matter and over this again an envelope of pure crystalline carbon. Gardner Williams gives one remarkable instance of this occurrence. He says: "Some years ago, a diamond weighing $28\frac{1}{2}$ carats was found in Kimberley. The external surface of the diamond was smooth and crystallized, showing no other material except the diamond itself. The interior of the diamond was white, but not transparent, and owing to its peculiar appearance the valuator broke the stone in order to satisfy his curiosity. A small, perfect octohedral diamond was enclosed in the centre of the larger diamond. Nor was this all. There were flakes of white mineral, not diamond, attached to the fragments of the broken diamond. A few grains of these were collected and analysed by Professor Lawn of the Kimberley School of Mines. In appearance the flakes were white, translucent, and crystalline, and about as hard as the steel blade of a knife. When heated in a closed tube, moisture was given off. The mineral was very slightly effervescent, probably due to a trace of carbonate of lime. It fused readily on platinum wire to a white bead. The mineral was determined to be apophyllite, a silicate of

lime and potash with 16 per cent of water."

Here, then, we have proof positive that diamonds grow, for after the formation of the small octohedral diamond crystal, we have an envelope of calcareous matter and then a further deposition of diamantiferous coating making up a crystal of $28\frac{1}{2}$ carats.

I have said that I would give an instance where the tailing from a diamond pipe in India has been worked over and over again for hundreds of years although the tailing consisted of matrix reduced to the consistency of fine mud, so that there was no possible chance of it containing portions of unweathered blue. The workings to which I allude are on the Panna diamond-field, the most northern of the diamantiferous areas. Franklin thus describes this pipe of blue ground: "At Majgola (Majgama) south-west of Panna and the most westerly point of the district occupied by this group of mines, the mode of occurrence of the diamonds is peculiar. They lie in a green mud which is penetrated by veins of calcite and is covered by a thick deposit of calcareous travestine or tufa. This mud is found in a conical depression in the sandstone, about two-thirds of which it fills. This depression is one hundred feet deep and one hundred yards wide and being cone shaped diminishes in diameter as its depth below the surface increases; it may possibly be an old diamond mine filled up by the green mud. The miners work to a depth of 50 feet and assert that the mud increases in riches as greater depths are reached. The mine is now apparently abandoned; it is not, however, considered to be exhausted but is reserved for future working."

At the time of my visit in March, 1883, the pipe itself was not being worked, but some 40 people, men, women, and children, were engaged in re-working a portion of the tailing heap of black mud, which extended for some three or four hundred yards along the downward slope of the ground to the west of the pipe. A section of this debris was portioned off by surface trenching and the tailing within the partition was being conveyed in baskets by the women and children to the washing-floors. The ground rises to the south and the washing-floors are situated well up the slope, so that the puddled mud and water escaping from the washing-floors find their way by gravity and fill the empty space in the partition of the tailing heap then being worked. The washing-floors are 6 ft. square and about $2\frac{1}{2}$ ft. deep, and are lined, bottom and sides, with thin slabs of sandstone, common hereabout. Stiff clay packing on the exterior makes these

washing-floors impervious to water. On the north face of the ground floor are several apertures about six inches square, covered with perforated iron sheets and backed with pellets of straw.

Into these washing-floors the black mud from the tailing heaps is thrown. The women bring pots of water from the neighbouring wells and pour it over the black mud, which is then kneaded by the men to the consistency of pulp, fresh water being added until a muddy stream escapes from the vents along the north side of the floor. This muddy water is conducted by an open channel to the tailing heap. I have tested the drainage from these vents and feel certain that the whole of it would pass through a 30-mesh screen. Water is added until the whole of the mud escapes and only half a cubic foot or so of gravel consisting of nodules of limestone is left on the washing-floor. This is carefully collected and searched over, and at times a few diamond crystals are found among the gravel.

I was told by an old diamond-worker that the returns were very small indeed and just gave the workers a subsistence and no more, and that they only resorted to the working of the tailing heap when they had nothing better to do. The nodules of limestone, he told me also, grew in the tailing heaps.

I was careful to note that it was the mud from the blue ground and not the shingle it originally contained that was re-worked. This shingle was piled away in separate heaps from the black mud. I have noticed that the diamond-workers in other parts of India also confine their operations of re-washing to the mud and not the gravel contained in the diamantiferous conglomerate.

A. MERVYN SMITH.

London, April 1.

[This interesting letter was not dated. We supplied the date.—EDITOR].

Famatina.

The Editor:

Sir—I see by the report, issued to the public, regarding the first smelting campaign with the Famatina company's new plant, that the consulting metallurgist suggests, as a possible remedy for existing troubles, "to concentrate low-grade ore and to pick rich ore and smelt in reverberatory furnace," and he supplements this suggestion with the remark that "probably oil concentration will be most suitable process."

I am bringing this to your notice, because, if you intend to make any comment in *The Mining Magazine* on the report, it might be

as well to note that I have described in the March issue the Famatina ore as "a dense pyrite of fairly uniform composition." As such, it is anything but suitable for oil concentration. I came to this conclusion, emphatically, on the spot, after careful observation, made, I may mention, because of the opinion possessed by some of the Famatina officials that oil concentration was some system of obtaining a rich product from any pyritic ore, by the elimination of all worthless material, totally regardless, apparently, of whether the material to be eliminated be pyritic or not.

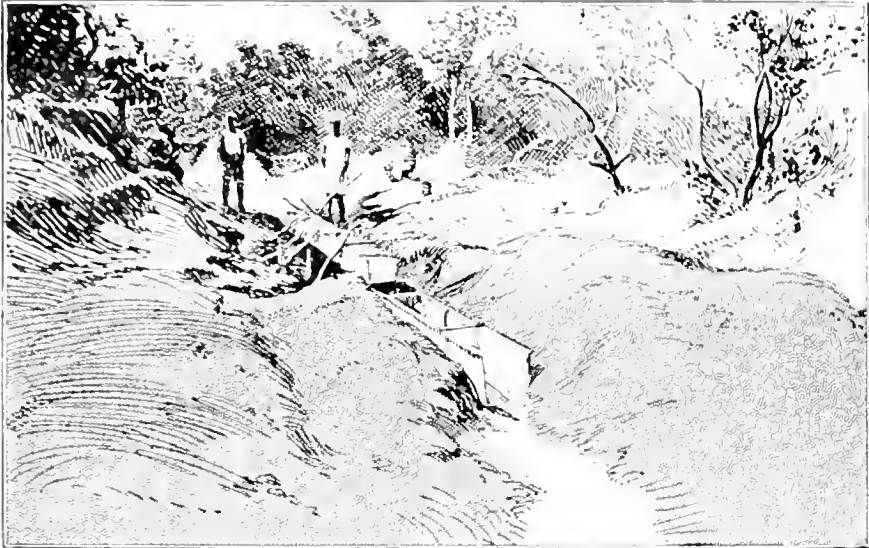
I fear that the remedy does not lie along the lines suggested.

W. E. SIMPSON.

London, April 2.

in a light coloured rock, was responsible for the extravagant terms used to describe a by no means uncommon mineral occurrence.

It is well known to all who have followed the course of this business that several independent engineers visited the property last year, and, as a result of inspections varying in length from two hours to two days, formed an adverse opinion both as to the immediate value and the possibilities of the discovery. According to the report of the proceedings at the meeting of the Anglo-Continental Mines, held on the 19th instant, Mr. W. R. Rumbold, consulting engineer to the company, reports, as a result of a number of months' work under his direction, that there is really no hope for the property, and that it is valueless, but he



SLICING IN NIGERIA.

Exit Jemaa!

The Editor:

Sir—Thus *The Financial Times* announces the burial of the romance of the great tin deposit that was to rival the Rand, and it is fitting that the ceremony should have been carried out in the presence of three hundred people.

To mining engineers the history of the Jemaa fiasco points a moral that should not be disregarded. There are more fools than knaves in the mining business. I am ready to believe that the men who stood sponsors for the statements that were issued to the public were honest, and that enthusiasm born of the spectacular display of coarse black tin, and associated with equally coarse black tourmaline

adds: "I consider the property was well worth prospecting and that no sane mining engineer could possibly turn down an outcrop such as there is at Jemaa Central without thoroughly testing it, however much he disliked the geological conditions, unless of course for Stock Exchange reasons."

Mr. Rumbold mentions no names, otherwise his statements might be libellous, but he makes accusations against other members of the profession, whose opinions, formed from a mere inspection of the property, have been borne out and justified by a number of months' active development work. Surely, the man who was clever enough to appraise the discovery and form an adverse opinion, can be given credit for honest motives, even if a

brother engineer, less clever, requires a large expenditure of money on development work to have the same facts demonstrated to his satisfaction. Is Mr. Rumbold, or any other engineer, justified in making a sweeping assertion, such as he has made, for the edification of a non-technical and not always friendly public? The profession of mining engineer does not stand on too high a plane in this country, because in the past accusations, such as are implied here, have at times been only too justly applicable. I am familiar with the reports of four engineers who inspected the property last year, and who in substance arrived at the same opinion, and I am sure that each one of them was not influenced in the slightest by an ulterior motive, and would have been only too glad to state that the property had a chance. To some of these men I know it was quite apparent that there was no possibility of this ore persisting in depth, and for this reason they condemned the discovery as unpromising.

All the adverse reports in the world would not have hurt the Jemaa lode if it had been even one-tenth as good as its management claimed it to be.

C. S. HERZIG.

London, March 27.

Premature Precipitation.

The Editor :

Sir—In your January issue Mr. D. F. Foster returns to the discussion of the above subject, skilfully draws a red herring across the trail of argument, and gives his opinions on the commercial aspect of a metallurgical test and the historical aspect of charcoal precipitation. The communication provokes reply, otherwise I should have been willing to leave the matter to the judgment of your readers.

To return to the question as to whether the premature precipitation of gold and silver is induced by the presence of charcoal and organic matter: in dealing with Mr. Foster's results in an earlier issue I mentioned that "during the last 16 hours of agitation the amount of metal dissolved would not have paid for half the cyanide consumed." As this was one of the tests upon which Mr. Foster based his conclusions, it is obvious that his recent homily on lack of appreciation of the commercial aspect of a metallurgical test is sadly misdirected. It is difficult to know which to consider, precept or practice. If Mr. Foster is to be taken seriously, and any extraction other than the one calculated from the commercial standpoint is "erroneous," then it fol-

lows that the degree of solution or precipitation of the metals is only determinable upon an acquaintance with their money equivalent; and a market fluctuation in the value of one of the metals could be used to influence the statement of solution percentage, or to strengthen or weaken the suggestion of premature precipitation. The contention is manifestly illogical. The percentage extraction of valuable content is not affected by market fluctuations, hence such extraction must be differentiated from the percentage extraction in terms of current metal value. The latter has no place for consideration in the results of a metallurgical test that are being used to prove or disprove the probability of a chemical reaction.

Mr. Foster still quibbles over dates. I have already pointed out that a final settlement of the question would not affect the argument one way or the other. A profession of versatility in connection with recent cyanide literature is equally beside the point, since the absence of a definite statement in a publication cannot logically be used as an argument against the verisimilitude of such a statement. Mr. Foster quotes Clennell, McFarlane, and von Bernewitz. Two of these have not yet dealt with charcoal as a precipitant, and the third alludes to its use in the past tense. With the help of such doubtful evidence, Mr. Foster becomes still more positive. He is welcome to his opinions. They may, or may not, be interchangeable with facts. Personally I still think that, even neglecting the question of ordinary practice, there is the strongest probability of present-day instances where final values are still being recovered from excess or fouled solution by means of charcoal precipitation.

Mr. Foster's original contribution touched upon an important subject, and his conclusions were directed against the precautions that are taken against the inclusion of what are generally admitted to be undesirable concomitants of cyanidation. The original figures upon which these conclusions were based showed that abnormal cyanide consumption was occurring during the tests. There was no explanation accompanying the publication of these peculiarities, neither has Mr. Foster taken the opportunity of referring to them in his replies.

Had all the figures given been corroborative and normal, I should still have differed from Mr. Foster in his conclusions, because the successful treatment of less than 30 tons of such material is no criterion that fouling of plant solution would not occur in ordinary

practice after larger quantities had been handled. My own experience in the treatment of fillings from old stopes in Mexico has resulted in the firm conviction that an ultimate fouling of the solution was inevitable when any quantity of refuse was treated with the ore, and premature precipitation and other kindred ills are best prevented by sorting the material going to the mill to the exclusion of the organic matter.

A. W. ALLEN.

Lonely Reef, Rhodesia, Feb. 20.

Continuous Decantation.

The Editor:

Sir—I note in your February number a review of an article on continuous decantation, describing the plant of the Ophir Gold Mines, Milling, & Power Co., in Colorado, which wrongfully gives me credit for having designed the plant and our company for having erected the same. Not desiring any credit to which I am not entitled, I will ask you to state that the plant was both designed and erected by Mr. Justin H. Haynes, general superintendent for the Ophir company.

I note also you state that "normally the plan would be to send the barren solution to the last thickener." This would not be done in any case, as except where a filter is used, the saving in cyanide by diluting the underflow from the thickener next to the last with water alone will more than compensate for the slightly greater loss in gold thereby.

JOHN V. N. DORR.

Denver, March 10.

Nissen Stamps.

The Editor:

Sir—With reference to Mr. Nissen's remarks in your last issue, your readers will probably already have noted that I had anticipated the point Mr. Nissen makes in my letter of February 20 to the *Mining and Scientific Press*, by disassociating in this connection from the rest of the Rand the group responsible not merely for the conduct of the tests at the City Deep but for the prompt and free publication of the results to the industry. This action of the Corner House was undoubtedly wise and far-sighted, for by the publication of the results it materially assisted Rhodesia and other outside territories in their decision to adopt the Nissen stamp.

The wisdom of the policy of the Corner House in breaking away from the secrecy as to results which has characterized the investigations of the Mines Trials Committee must

be obvious. In its future mills it will have the advantage of all the improvements being made on the Nissen stamp as a result of the number of new mills laid down on the publication of the City Deep results. In other words, instead of having to go to the expense of making these improvements itself at its next mill, the Corner House will have them already made and ready for their free adoption, as a result of the new mills laid down on the City Deep results.

It is this policy of co-operation in the industry which prevents the same mistake being repeated a hundred times by a 100 different companies and gives the 99 companies, free of expense, the achievements effected by one. In other words, the policy of co-operation between a 100 companies theoretically reduces errors by 99% and makes advantages available to each mine at 1% of the actual cost.

ALFRED JAMES.

London, April 3.

'Indicated' Ore.

The Editor:

Sir—I enclose a cutting from the Johannesburg *Star* of March 13, which gives an official statement from the secretary of the Rooiberg Minerals Development Company as to the general conditions of the mine.

The said statement gives the total ore and partly treated products as at January 31, 1913, as 151,500 tons. This tonnage includes 90,300 tons of "indicated" ore, whatever that may mean. I and a great many other members of the Johannesburg Stock Exchange are of opinion that "indicated" ore might have been described as 'imaginary' ore, and that it is improper to say on such a basis that the mine is "at least four years ahead of the mill."

We invite your powerful aid to prevent a company like the Anglo-French permitting such statements being published.

A MEMBER OF THE JOHANNESBURG
STOCK EXCHANGE.

Johannesburg, March 17.

We are glad to publish this protest. Of course, the use of such a term as 'indicated' is highly objectionable, unless special care is taken to explain the exact sense in which it is employed; even then it is undesirable, as the explanation may not accompany each use of it. 'Indicated' means shown or made known, but the degree to which this is done must be guessed. It is too much like the phrase used in a report upon a Rhodesian mine, which was said to contain so many tons of "more or less probable" ore.—EDITOR.]

KYSHTIM

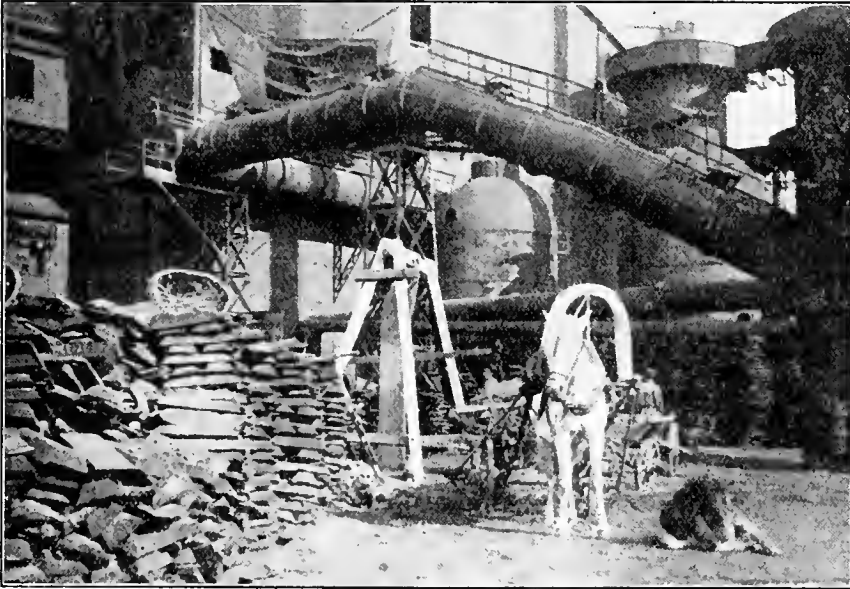
By J. P. B. WEBSTER.

Notes on the growth of an important Siberian industry, by the Secretary to the Kyshtim Corporation.

INTRODUCTORY.—Mining at Kyshtim, Siberia, now well known by reason of the operations successfully undertaken in the search for copper by the Kyshtim Corporation, a British organization, had its first start in the exploiting of iron deposits for local foundries. The first ironworks were erected at Kasli in 1747; two years later the Niazepetrovsk works were completed, and in 1757 the Kyshtim ironworks came into operation. These three establish-

1750 square miles of forest, 146 square miles of arable land, and 30+ square miles of lakes and rivers.

Gold was found in the Soymonovsk valley in 1822 and this led to the discovery of contact copper deposits, some of which are being developed at the present time. In 1834 permission was given to erect 8 copper-smelting furnaces in the Soymonovsk valley to treat ore from the contact deposits; these furnaces



KYSHTIM IRONWORKS.

ments, which belonged to different owners, were erected in consequence of the development of the Ural iron industry; at that time some 30 ironworks, privately owned, were in operation, the liberated serf labour being, no doubt, an important factor.

In 1809 the freehold of the Kyshtim, Kasli, and Niazepetrovsk ironworks and estates were purchased by L. I. Rastorgueff, many of whose descendants are shareholders in the present company. The three estates became known as 'The Kyshtim Mining District,' the total area being 2200 square miles, divided as to

were only completed in 1837, and after smelting operations were commenced it was found that the plant was too small, so 4 additional furnaces were built. This plant, after producing 22 tons of copper, was closed-down in 1842, owing to the low copper content of the ore, and the failure to open-up further deposits. It would seem, however, that this decision was also affected by the large quantity of gold then being won in the valley, returning a much greater profit than the smelting of copper ore.

The Tetcha sheet-rolling plant was erected

in 1845. Not much of historical interest can be recorded from that time onward until 1905, when copper ore was found in the Koniukhoff mine.

COPPER. Sulphide gold bearing ores were discovered under amiron gossan on the Koniukhoff and Smirnof mines and these ores were treated at a cyanide plant erected in the neighbourhood. It was found that in depth these ores, while retaining their precious metal contents, carried more copper. Systematic diamond-drilling soon proved the existence of a large body of copper ore in the Koniukhoff mine; similar large bodies have been since discovered in the Smirnof and Karpinsky mines, and the latest strike at the Americansky promises further large reserves. The proved and probable ore reserves at the present time are estimated by the consulting engineer, R. Gilman Brown, to amount to 2,369,000 tons, averaging a little over 3% copper.

Pyritic smelting being then unknown in Russia, two small circular water-jacketted furnaces, with small converters, were erected in 1907 at Kyshtim for experimental purposes. The ore was carried in carts and sleighs for a distance of more than 20 miles. To avoid this costly and difficult method of transport, two furnaces of the same type were erected near the Koniukhoff mine, the matte there produced being shipped to Kyshtim for converting in the original plant.

The construction of the present large copper-smelting plant at Karabash was commenced in 1909; the first rectangular water-jacketted furnace was blown-in toward the end of 1910, the second furnace coming into operation in January 1911. A third furnace has subsequently been erected. A narrow-gauge railroad connects the mines and smelter with the main Government line at Kyshtim.

The growth of the Kyshtim copper industry is indicated by the following figures of output:

1909.....	1135 tons.
1910.....	1674 "
1911.....	5140 "
1912.....	7507 "

The output for 1913 is estimated by the consulting engineer at from 7600 to 8000 tons.

The treatment of fine ore and flue-dust presented considerable difficulties. Experiments under the direction of the consulting metallurgist, Walter G. Perkins, were made in a small gas fired Siemens-Martin open-hearth regenerative furnace, part of the ironworks plant at Kyshtim; as these experiments proved

successful, a second furnace, with increased hearth-area, was erected, and McDougal roasters are now being provided. It is probable that a large modern reverberatory furnace will be shortly installed as part of the permanent plant at Karabash.

As the ores carry the precious metals in profitable quantities, an electrolytic refinery was constructed and came into operation in 1909; since then it has been considerably enlarged to keep pace with the increased output of blister copper. About half the present production of refined copper is sold in the shape of wire-bars, which are cast at the refinery.

IRON.—The three principal ironworks, Niazepetrovsk (sheet iron), Kyshtim (merchant iron), and Kasli (castings), have now been in operation more than 150 years, and were the chief source of income until recently. With the development of the South Russian iron ore deposits and neighbouring coal mines, prices of iron fell considerably, and the absence of means of communication and marketing facilities caused the Ural iron industry, after a century of prosperity, to undergo a crisis from which it is only now recovering.

There are numerous iron deposits on the Kyshtim estates, but the ore rarely exceeds 50% Fe. Most of the mines are worked by open-cut, the ore being washed before carting to the works. Charcoal fuel prepared on the estates is used for smelting. By an extensive system of canalization the water from the neighbouring lakes was utilized for power purposes at the ironworks, and even at the present time considerable power, particularly in the spring months, is obtained in this way.

The rolling-mills at Kyshtim, Tetcha, and Schemacha have now been closed-down, also the blast-furnaces at Kasli, the pig-iron being supplied from the Kyshtim works. The present annual output of charcoal sheets is approximately 12,000 tons: and of castings, 5000 tons.

GOLD.—As above mentioned, gold was discovered in the Soymonovsk valley in 1822. The records from 1844 to 1899 show that some 10 tons of gold were brought to the company (say £1,000,000). As most of the gold was won by tributors, who received from the company but a part of its value, it is safe to assume that the valley produced much more than the figure above given.

Toward the end of last century a vein rich in gold was discovered at Karabash, and a Chilean mill was constructed. Later a cyanide plant was erected to treat the gold-bearing sulphide ores in the upper levels of the



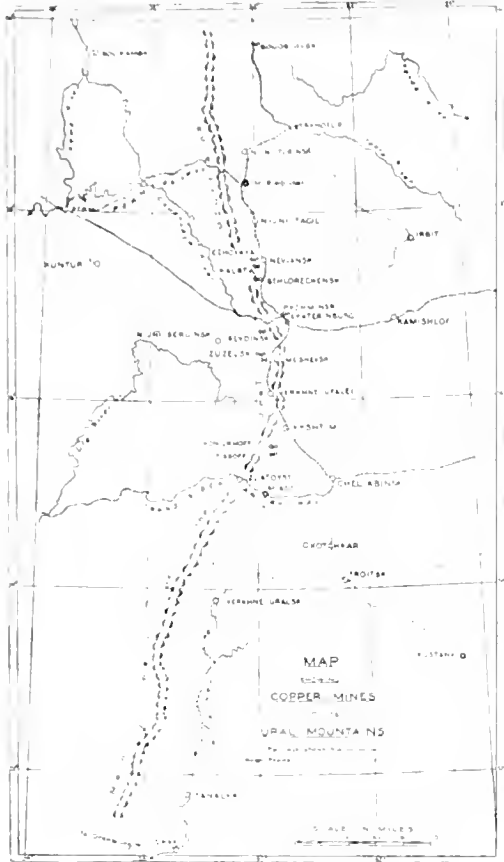
NORTH END OF THE OPEN-CUT WORKINGS AT THE TISSOFF MINE.



SOUTH END OF THE OPEN-CUT WORKINGS AT THE TISSOFF MINE.

Komukhoff and Smirnoff mines, but both these plants have been dismantled.

TIMBER. The Kyshtim forests cover more than 1,000,000 acres, the quantity of standing timber (principally pine and larch) being estimated at 100,000,000 cubic yards. Clearings have been made throughout, dividing the forests into blocks of two-thirds of a square mile each. Afforestation is on a basis of 50 years growth, that is, the maximum yearly quantity felled is limited to 2,000,000 cubic yards,



About three-fifths of this quantity is used for mining and smelting requirements, the remainder being available for sale on the market (as sleepers, fire-wood, etc.), and to local people. To permit the free growth of the young trees, all branches and roots are cleared, and these have been successfully used as fuel for the regenerative gas-fired furnaces.

To utilize the timber in the least accessible districts, charcoal-burning stations are organized throughout the estates, this charcoal being transported to the iron-works during the winter months on sleighs. The system upon

which the charcoal kilns were built does not permit of the recovery of by-products, but an experimental distillation plant has now been erected, designed to give a better quality of charcoal, and to permit of the recovery of tar, turpentine, wood alcohol, and acetate of lime.

While on the subject of fuel, it is interesting to note that the large peat deposits on the Kyshtim estates are now being exploited: the peat is cut, pressed, and dried during the summer months, and although the operations at present are on a small scale, the results, particularly in gas-generators, have been sufficiently satisfactory to warrant the installation of further plant.

OTHER INDUSTRIES.—About 20,000 tons of iron pyrite are sold yearly to sulphuric acid manufacturers. The ore is obtained from the open-cut workings at the Tissov mine, but even with low costs of mining and direct rail-communication with the Government main line, the profit from this source is small, and the demand very limited.

Extensive deposits of corundum have been discovered, some of the rock being of good quality.

Coal Resources of the World.—The chief subject for discussion at the forthcoming International Geological Congress is to be the coal resources of the world, a study analogous to that of the iron resources of the world, which formed the subject at the Stockholm Congress. The preliminary inquiries are now complete, and the information has been published in the form of three quarto volumes and an atlas of 70 coloured maps. Fifty-two different countries are covered, of which 37 receive detailed treatment, the other 15 not being of sufficient importance to warrant more than short notices. Many leading geologists have taken part in this compilation. The English coalfields are described by Aubrey Strahan, president of the Geological Society, and an authority on the South Wales coalfield. Other contributors are: Marius Campbell, United States; D. B. Dowling, Canada; H. Kynaston and his colleagues on the Geological Survey, South Africa; E. F. Pittman, New South Wales; and H. H. Hayden, India. We have in our editorial columns in a recent issue made reference to the programme for the Congress, and described the various excursions ranging from Nova Scotia in the east to the Yukon in the west. Coal will by no means form the only subject of discussion at the Congress, for the mineral resources of the Dominion will also receive attention.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

Mar. 1913	Feb. 1913	Mar. 1912
£65. 8s. 9d.	£65. 12s. 5d.	£66. 0s. 4d.

The improvement in demand which we were able to chronicle in our last issue has made further progress. Continental consumers, who for the past few months were buying from hand to mouth, have purchased freely for April delivery. Their reserves have manifestly become depleted, and orders are now being pressed forward that were held back at the outbreak of the Balkan war. The demand has been heaviest for early delivery, and fortunately for buyers this has been met out of shipments to this side made by American producers to relieve accumulations at the refineries. The American shipments for March were swollen to no less than 41,702 tons, while European stocks show little change. In America a similar demand is in progress, so that the statistical position there promises to show a reversal of the picture of steadily increasing stocks. The effect on prices is marked, electrolytic having been raised from 14 $\frac{3}{4}$ to 15 $\frac{1}{4}$ c., and sales at 15 $\frac{1}{2}$ c. in the case of one agency being reported.

The standard market has responded in tone rapidly; large transactions have taken place, and the price carried to £68. Prospects point to a further advance, for, in addition to the growing confidence in a peaceable solution of European troubles, reports are received of the closing of the Cananea smelter for want of fuel and of another strike at Rio Tinto.

TIN.

Average prices of cash standard tin :

Mar. 1913	Feb. 1913	Mar. 1912
£213. 11s. 10d.	£220. 6s. 3d.	£192. 15s. 0d.

This market has shown less than its usual animation and has been free from aggressive manipulation. Prices have remained at a high level with a downward tendency, both factors interfering considerably with consumptive demand. In spite of this, the result of the Banca sale was unexpectedly good, when the high average price of £219 was realized. The sale was followed by ostentatious selling on the part of a leading London dealer, and the cash price fell to £215. The March statistics, however, by revealing a shrinkage in supplies of 1231 tons, threw a favourable light on the position, and their publication was followed by a scramble for the metal, which raised the price again to £220. 10s. In England con-

sumption is poor, and many of the tinplate mills are closed. American demand shows no slackening. Early in the month buyers there were shy, but showed increased appetite later. They then bought largely in Singapore and Penang, at about £214.

LEAD.

Average prices of soft foreign lead :

Mar. 1913	Feb. 1913	Mar. 1912
£15. 19s. 8d.	£16. 8s. 5d.	£15. 19s. 8d.

The arrival of several delayed parcels of metal threw dealers into a panic, and prices registered a decline of nearly £1 in the course of a week, through forced realizations. That this sacrifice was unnecessary is shown by the recovery that has since taken place to £16. 10s., or 5s. higher than at the close of February. Russian demand is heavy, and London dealers have sold largely to that country. Home trade is also active, consumers holding off as they usually do until necessity drives them to pay heavy premiums for spot supplies. Prices appear high enough, however, and should remain steady unless further curtailment of supplies takes place.

SPELTER.

Average prices of good ordinary brands :

Mar. 1913	Feb. 1913	Mar. 1912
£24. 11s. 4d.	£25. 4s. 3d.	£25. 19s. 11d.

No movement has taken place in the prices of this metal. The syndicate has not yet lowered the price as anticipated. On the other hand, consumers are marking time, although their stocks must be getting low. If their ideas of price are met by the syndicate, a large business will no doubt be effected. In the meantime American sales to English galvanizers are reported.

OTHER METALS AND MINERALS.

Prices quoted on April 10:

SILVER.—27 $\frac{1}{4}$ d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £90 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£32 to £35 per ton.

QUICKSILVER.—£7. 10s. per flask.

MANGANESE ORE.—10d. to 1s. per unit.

IRON ORE.—Cumberland hematite 27s. per ton at mine. Spanish 21s. 6d. delivered in England.

PIG IRON.—Cleveland 66s. per ton. Hematite 80s. per ton.

WOLFRAM ORE.—33s. per unit (1%).

THE NATURE OF CORNISH TIN ORES

A Physical Analysis relating to the occurrence of Tin Compounds in Granite and Killas Ore.

By H. W. HUTCHIN.

THE history of Cornish mining presents a record of progress; of that record just a few features are sufficient for my purpose. In the dressing of the ore it has and is making progress; in the crushing of the ore it has kept in line with the world's progress in stamps, but has still from the point of view of graduated crushing a need for a stamp more suited to its requirements. Progress in concentration may be traced in the evolution of the buddle, from the square buddle to the various forms of round buddles and the revolving slime-tables, the latter a form of buddle suitable for the treatment of the finest material. The buddle has not wholly disappeared from Cornish dressing-floors. Thus at Carn Brea & Tincroft it constitutes the principal means of concentration; but in most other mines its use is for subsidiary purposes. About 30 years ago Dolcoath abandoned the buddle system, and substituted Frue vanners for the first stage of concentration; the final stages of concentration being effected with a judicious use of shaking tables, Frue vanners, and buddles. In addition, an extensive and successful slime-plant has grown, with the progress made in recent years for the treatment of tin slime. At a later period East Pool and Clitters were equipped with plants suitable for graduated crushing, and of a necessity involving classification in front of the battery. Messrs. Dietzsch and Schiff, in a paper presented to the Institution of Mining and Metallurgy, described the plant and operations at Clitters; it is of interest to note that Mr. Josiah Paull, now at South Crofty, was at that time manager of Clitters.

With the advent of Mr. Beringer's wet assay for tin, I was enabled to contribute a paper to the Institution, in which attention was drawn to the influence of the mesh of battery-screens on the dressing of tin ores. On Mr. Josiah Paull succeeding to the management of South Crofty, he initiated and carried to completion a further and more exhaustive series of tests with various sized screens. The results are so far unpublished, but I am indebted to him for much of the matter embodied

in this paper. It is well known that at South Crofty 14-mesh screens five years ago took the place of 25-mesh used previously. At East Pool the Holman stamps are worked with wire screens of about the same aperture, 14 to 15 mesh, with, I understand, satisfactory results. More recently the experiments at King Edward mine have been published, and support the practice of the mines above mentioned.

With the general adoption of the wet assay for tin, the losses have recently come into prominence, and tin-dressing in Cornwall has been subjected to unjust criticism by some whose knowledge is more superficial than real. Before dealing with the problem of the present day, it would not be amiss to review the past. The Carn Brea tailing-dump presents a record of days gone by. Published figures give it an average assay-value of 17 lb. metallic tin per ton, and recent milling results by the Cornwall Tailings Co. of 21 lb. per ton. Tailing now being added averages about 6 lb. per ton.

Another record is presented by the published figures of the sampling of Gwithian Beach. From the figures, the assay-value of the sands as a whole appears to be about 8.5 lb. metal, which, allowing for a dilution of 50% with sea sand, brings the assay-value of the mine sand to about 17 lb. In neither instance do the products include slime; records of unworked slime of the past show assay-values of 24 lb., or higher, per ton.

The losses today are not so great. Thus Carn Brea mine working ore whose content is only from 20 to 21 lb. per ton could only equal the past by putting the untreated material on the waste heap. And so with other mines, a lower grade of ore means a lower tailing value.

What, then, is a tin ore? And what is a tailing? How much tin does it contain, and in what form is the tin carried, and what are the causes of loss?

Real knowledge of a tin ore can best be gained by a study of the black tin saved from it, and by a study of the waste or tailing produced in saving the black tin.

The assay-value of a tailing may be anything from, say, 5 lb. upwards, depending upon certain factors :

- (1) The assay-value of the ore treated,
- (2) In some degree upon the method of treatment,
- (3) Upon the characteristics of the ore-body.

In a general way tailings have one feature in common, and that is, that the greatest losses are in the finest portion, that which passes a 200-mesh sieve.

As an example, I give a grading analysis of a tailing by wet screening through 200-mesh.

Mesh	% of whole	Metal content lb.
+ 200	51.5	3.5
- 200	48.5	10.5

It is customary to speak of the + 200 size as 'sand,' and the - 200 as 'slime.' The tin in the sandy tailing is carried enclosed in the particles of sand, the tin in the slime is present mainly as fine separate grains of cassiterite as well as a little enclosed in the matrix.

Burnt leavings are a particular tailing produced in the final stages of concentration, in quantity much smaller than the general tailing produced in the first stage of concentration. The assay-values are usually high, from 20 to 90 lb., but all characterized by giving low vanning assays.

An investigation of two samples of burnt leavings from different mines was made, and the results are tabulated in (A) and (B) Table I.

Ordinary grading analysis with screens on material B :

Mesh	% of whole	lb. metal per ton,
+ 160	35	19
+ 200	18	27
- 200	47	45

The same material cleaned with acid and screened gave :

+ 160	27	25.5
+ 200	4	—
- 200	25	90.5
loss in acid	44	—

A worker carrying out such a set of experiments has no difficulty in recognizing cassiterite as strongly in evidence. The causes of loss in burnt leavings may be summarized : (1) Fine cassiterite so contaminated with impurity, principally iron oxide, that its density is too low for concentration. (2) Fine cassiterite locked up in the small particles of rock. The same factors, to some extent, influence the losses in the tailing from the first stage of concentration.

Of the black tin sold by Cornish mines a comparison of the varying texture is seen in the following table :

MINE	A.	B.	C.	D.	E.	F.	G.
+ 120	5.5	30	13	14.5	32	16	38
+ 120	15.0		17	19.5	22	19	21.5
+ 200	79.5	70	70	66.0	44	65	41.5

(F) and (G) are samples of black tin produced by the same mine and from the same ore ; (F) results from using 25-mesh screens, and (G) from 10-mesh screens.

TABLE I.

A.	% by weight.	Assay-value.	Assay-value calculated on original.
1 Soluble in acid	23.29	—	—
2 Slime	6.68	91.5 lb	6.11
3 Light sand	61.5	9.5	5.94
4 Heavy sand	8.63	74	6.19
Average = 18.25 lb. (Direct assay 19 lb.)			
B.			
1 Soluble in acid	51.6	—	—
2 Slime	4.83	136.7	6.60
3 Light sand	37.65	17.5	6.59
4 Heavy sand	5.91	313.2	18.53
Average = 32 lb. (Direct assay 33 lb.)			

The procedure was to treat a weighed quantity with warm hydrochloric acid, and then to wash with water by the decantation method till the residue readily subsided in water. The washings were saved, and the fine sediment it contained (entered as slime in the tables) collected and assayed. The residual sand was dried and separated with a heavy solution (sp. gr. = 2.808) into two portions, 'light sand,' the portion that floated, and 'heavy sand,' remaining unfloat, being of a specific gravity higher than 2.8. The 'light sand' and 'heavy sand' were in each case weighed and assayed.

It is, therefore, unwise to draw inferences as to the fineness of the tin in the ore from the fineness of the black tin obtained, and, on the other hand, it is not wise to insist that some ores do not contain the black tin in a very fine condition.

Let us leave for the time generalities, and proceed to the study of two types of ore and the waste products obtained. The types of ore are :

- (1) Ore from lodes in granite, or 'Granite Ore.'
- (2) Ore from lodes in killas, or 'Killas Ore.'

TABLE II.

I. ORE FROM LODES IN GRANITE.

Mesh of Battery Screen	Grading Analysis.		Assay of Original.	Assay of +200	Assay of -200	%Tin contents in -200	Ratio.
	+200	-200					
20	49	51	17.5	11.5	21.25	73.8	1 : 2.81
14	63.3	36.7	17.5	14.75	22.25	46.5	1 : .87
10	64.0	36.0	19.5	17.0	24.0	44.0	1 : .8

II. ORE FROM LODES IN KILLAS.

20	47.5	52.5	15.75	15.0	16.0	54.7	1 : 1.21
18	54	46	34.0	27.0	42.5	57.2	1 : 1.24
16	57	43	37.0	30.75	46.0	56.6	1 : 1.31
10	69	31	19.25	17.0	24.0	39.2	1 : 6.45

The vanning-assay with the granite ore returns from 50 to 60% of the tin contents ; with the killas ore about 35%.

With a plant laid out for graduated crushing the products claiming our attention are :

(1) The crushed ore or battery pulp as it leaves the screens.

(2) The tailing produced in the first concentration subdivided as a result of classification into (a) Buss tailing of sand, and (b) Frue-vanner tailing, mainly slime.

(3) Middling from the Buss tables are re-concentrated and the tailing re-ground and returned to vanners, thus joining the vanner tailing.

Slime tailing from the vanners are re-treated on rag-frames, and revolving slime-tables.

With respect to the battery pulp, the effect of various screens is set out in Table II for each type of ore. The effect of the screen on the size of the black tin saved has already been noted (see F and G).

If a tin ore were like a tin slag (assuming it to be free from prills of metal) the percentage of tin contents in the -200 would correspond with the percentage passing 200-mesh, no matter the size of battery screen used. Of the two, the killas ore more nearly approximates a slag in this respect. The difference is emphasized with 20-mesh screens. It follows that the tin contents of the killas ore are more widely distributed than in the granite ore.

The study of the tailing from each type of ore supports this conclusion.

BUSS TAILING FROM GRANITE ORE.

Battery Mesh	Assay of Feed Sample lb.	Assay of Tailing lb.
(1)	20	17.5
(2)	16	25.5
(3)	14	20.0
(4)	10	19.5

BUSS TAILING FROM KILLAS ORE.

(5)	20	15.75	4.5
(6)	16	37.0	12.0
(7)	18	34.0	12.0
(8)	10	19.25	6.0

The tailing from killas ore is in general higher than that of the granite ore, and it is but natural to inquire how the tin is carried and distributed in such material. Ordinary grading analysis only shows slight difference in assay-values ; generally speaking the larger sizes carry a little more tin than the smaller.

Separation of the minerals according to density by means of Sonstadt's solution (sp. gr. = 2.808) is distinctly useful. For reference purposes the sand which floats and is of lower density, as already mentioned, may be termed 'light sand,' and the denser 'heavy sand.'

BUSS TAILING FROM ORE IN GRANITE.

	Heavy Sand %	Light Sand %	Assay of Heavy Sand lb.	Assay of Light Sand lb.
(4)	7	93	18	1.5

BUSS TAILING FROM KILLAS ORE.

(5)	16	84	10.0	2.9
(7)	38	62	25.25	3.1
(8)	36	64	10.75	2.6

The numbers (1) (2), etc., are the reference numbers for the samples given in the preceding tables selected for separation with Sonstadt's solution. It is at once clear why the granite ore produces a relatively lower sandy tailing than the killas ore, and also why it is less influenced by increase of assay-value of the ore. In practice with a high grade of ore producing a 12 lb. tailing, re-grinding, etc., would be resorted to, but with ore producing from 3 to 4.5 lb. tailing, re-grinding is an unprofitable operation. Re-concentration of this poorer material yields a very small proportion of concentrate, assaying from 14 to 15 lb. metal only, a result in accordance with the

TABLE III.
FRUE-VANNER TAILINGS.

Description of Ore.	Battery Mesh	Percentage		Assay in lb.	
		+ 200	- 200	+ 200	- 200
(I) Granite ore	20	21.2	78.8	2.0	9.25
(II) " "	10	11.3	88.7	1.25	9.5
(III) Killas ore, 2nd size from classifiers	20	42.6	57.4	5.0	6.5
(IV) Killas ore, 3rd size from classifiers	20	14.0	86.0	3.5	6.75

assay of the denser sands obtained by Sonstadt solution, and also with the fact that the heaviest materials in the sand do not exceed a density of 3.

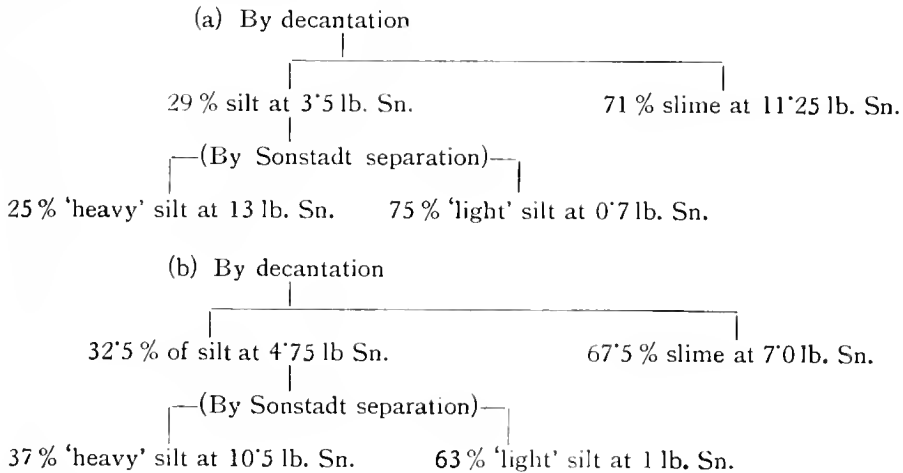
Apparently each ore retains its individuality, even in the finest of sand. The limitations of screening render investigation of slime difficult and tedious. A separation of the -200 may be made by the decantation method into two products: (1) That which settles most readily, which may be termed 'silt.' (2) The finest material of all, 'slime.' The silt can then with careful work be separated according to density by means of Sonstadt's solution.

Two examples will suffice: (a) the -200 Frue-vanner tailing of granite ore (II. in Table III above); (b) -200 Frue-vanner tailing of killas ore (III. and IV.) in equal parts.

It would appear, therefore, that the finest of

based on solubility in hydrofluoric acid. A sample of 'granite ore' when cleaned with hydrofluoric acid previous to the assay, gives slightly lower results. The black tin produced from these two ores is not soluble under similar conditions. The tailing from both granite and killas ore, when treated with hydrofluoric acid, give measurable quantities of tin in the solution. Thus a sample of Buss tailing from killas ore gave 0.6 lb. Sn soluble in HF, and a sample of Frue-vanner tailing 1.0 lb. per ton; Buss tailing of granite ore gave a trace, and Frue-vanner tailing of similar ore 0.85 lb. per ton.

Assuming for the moment that this is evidence of tin in the form of silicate, then it is almost a negligible factor. To be definitely accepted it should be proved by a totally independent method.



sand or silt still contains enclosed cassiterite, even those of lowest density, and our interest in the real nature of slime is stimulated to further inquiry.

So far, my assumption has been that the tin returned in the assays has been in the form of cassiterite; my method of procedure, while excluding stannite, would include tin existing in the form of silicates. The evidence of the possible presence of stanniferous silicates is

An attempt at proof or disproof of the existence of silicates was made by a method based on the effect of ignition of the tin ore with zinc oxide. Assayers working with Beringer's assay cannot fail to observe the degree of attack which the chloritic minerals of a tin ore undergo, an attack that renders them decomposable by hydrochloric acid in the later stages (See Table IV. on next page.)

At this stage of the investigation the dis-

TABLE IV. RESULTS OF IGNITION WITH ZINC OXIDE, ETC.

Description of sample	Assay-value	Assay as returned from	Assay as returned
	by usual method, lb.	ignition with ZnO only, lb.	soluble in HF, lb.
1 Frue-vanner tailing (200 portion granite ore)	9.5	1.6	0.8
2 Slime from Red River	16.0	2.6	
3 Frue-vanner tailing, killas ore	7.0	1.2	1.0
4 Slime from Zennor (highly chloritic ore)	21.5	9.5	0.75

crepancies between the two methods, namely, ignition with zinc oxide and solubility in hydrofluoric acid, could be explained on the assumption that the attack with HF of the silicate minerals was incomplete, as in fact it usually is. Further investigation of sample IV. (the chloritic slime from Zennor) speedily settled the question. A charge of this ore cleaned with HF, with removal of 60% of the mineral in doing so, and then ignited with zinc oxide, gave 9.75 lb. per ton as the effect of ignition; but another charge to which 200 milligrams of finely powdered black tin was added, and then ignited with zinc oxide, gave 39 lb. per ton, a result which can only be explained by slagging of black tin with the silica of the ore. As a method for the detection of tin as silicate it was evidently of no value; but on the other hand, it is an excellent demonstration of the function of the zinc oxide as used in this method of assay. But it does also appear probable that the amount soluble in HF is the maximum of tin possible as silicate, and it is still an open question as to whether any at all is present.

With regard to tin slime generally, the effect of coarser screens, together with low discharge, is a diminution of the amount of slime, but the assay-value remains practically the same. Closer screening up to 300 or 400 mesh if practicable might, however, indicate differences, for it is well up in 300 or 400 mesh that the losses in slime on Frue-vanners are to be found; screening at 200 gives only an average of many sizes. It is on this extremely fine material, well beyond the 200 mesh, that the saving with a slime plant is made. It is generally known that black tin recovered from slime is less pure than the 'crop' tin; the chief impurity (considering only 'clean tin ores') is ferric oxide and not silica. A slime tin rubbed down in a mortar assumes a brilliant red colour. It may well be that in some slime the fine cassiterite is so impure as to be more like iron oxide. In the 'granite ore' considered, it appeared to throw the higher slime value, and it is not without significance that all the dark greenish silicates ('heavy sand') separated by Sonstadt's solution from Buss tailing of this ore, all turned the reddish colour of ferric oxide when ground in the mor-

tar, while the similar products of the killas ore retained the characteristic bluish green colour.

My detailed work on slime is not sufficiently advanced for publication; the problem is beset with difficulty. It would appear reasonable at first sight to regard slime as simply a portion of the ore crushed to a much greater degree of fineness than the other portion, and to regard the tin contents as merely finely divided cassiterite and wholly separated from the matrix. On the other hand it must be noted that it is this portion of the ore on which the least saving of cassiterite is made and it is therefore a certainty that minerals of less density but still containing minute particles of cassiterite would not be saved. Also the slime may be regarded as the dumping ground for the decomposed portions of the lode, a by no means unimportant factor for consideration.

The evidence of the Red River is that, after miles of tin streaming, the tin content of the rejected slime is greater than the saving made by the streamers. How can these things be? Until a proper answer can be given to this question, our lack of knowledge is a stumbling block to progress. That the tin contained in slime is mainly in the form of cassiterite there appears to me to be little room for doubt, but whether the whole of that cassiterite is released from the matrix is a problem still to be solved.

Our two types of tin ore have distinct and different characteristics; it would be a mistake to assume that they are the only types, and it is to be hoped that on other mines metallurgists may be encouraged to study and record their experience. It is not to be assumed that all lodes in granite or that all lodes in killas are of the particular type quoted; thus lodes in killas of the granite type and on the other hand lodes in granite of the killas type are within my experience. Our two types collectively contain, then, a varying proportion of well developed cassiterite of saveable size, a proportion of cassiterite intermixed with the dark silicates, but so fine as to be saveable with difficulty or even not saveable at all, a proportion of cassiterite so impure with iron oxide as to seriously influence its density, and lastly a suspicion (and only a suspicion) that in the dark silicates of the ore is some tin which has as yet not developed into cassiterite.

JOURNEYS IN NIGERIA

Further descriptive notes concerning the hinterland of Nigeria, illustrated by the author's own sketches.

By J. B. RICHARDSON.

THE Bauchi plateau on its northern and western sides breaks down step by step to the surrounding plains in a series of tablelands and broad valleys, each separated from the other by masses of hills and broken country; but to the east and south, especially the south-east corner, the descent is more precipitous, for in one short day's journey the traveller descends from the plateau to the plain.

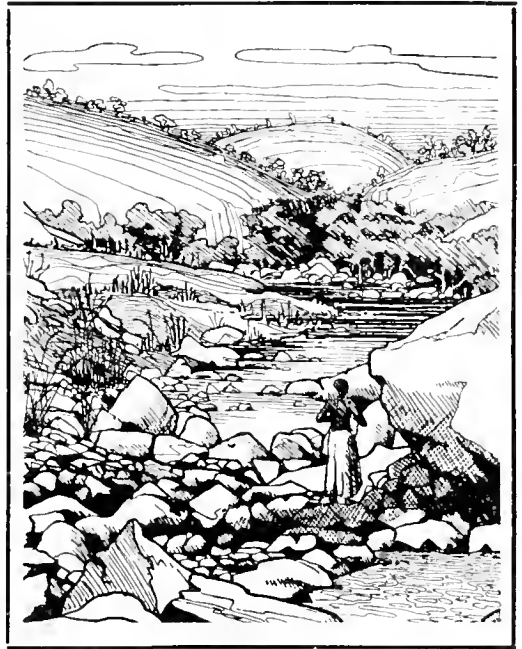
The country surrounding the plateau is, therefore, picturesque and varied in its scenery, with little wind-swept tablelands, broad valleys, snug sheltered dales, impressive rocky gorges with boiling torrents, and rugged ravines winding in and out among the stately granite hills.

From Rahamma to Bauchi there runs a well trodden trade-route, which taps a populous line of country to the north of the plateau, going through a number of interesting towns and villages. At Liruei-n-delma the traveller is well within the tin region; in fact, he entered it before reaching Dan Malaki.

Liruei is a town of several thousand inhabitants, and is situated in the broad Deleme valley. Near the market, where bracelets and ornaments of tin are an interesting addition to the ordinary produce, are the remains of two native tin-smelting furnaces, built inside two large mud-bound houses, with higher walls than usual. The furnaces are primitive, built of clay in the form of a dome, and supplied at one side, about six inches from the bottom, with holes, through which the native operator used to create a forced draught by means of bellows, raising the temperature of the mixture of tinstone, charcoal, and quartz. The molten tin ran away into a little trough-like depression on the other side of the furnace. The *seraki* or chief of this town had apparently in times past a prior right in the digging of black tin, and it is said that the inhabitants migrated to this Liruei from Liruei-n-Kano after "picking the eyes" out of that district.

If the traveller puts up for the night inside the town, he will find the rest-houses clean, well built, and dry. There are some that boast a raised corner of the floor, with a niche

in the wall like those in which the figure of a saint reposes in a church. But, however pleasant his housing may be, his sleep will be but fitful, for all night long Liruei is given over to the chatter of its raucous-voiced inhabitants and the howling of its many dogs, a persistent noise that is only drowned by the loud-tongued priest, followed by the shrill chorus of the native school, saluting the dawn.



End of the Dila Gorge.

About half-way between this town and Badiko, which lies on the eastern edge of the plain, flows the famous Deleme river, which is at all seasons a strong stream, and for a good many months of the year a deep, broad, turgid, swift-flowing river.

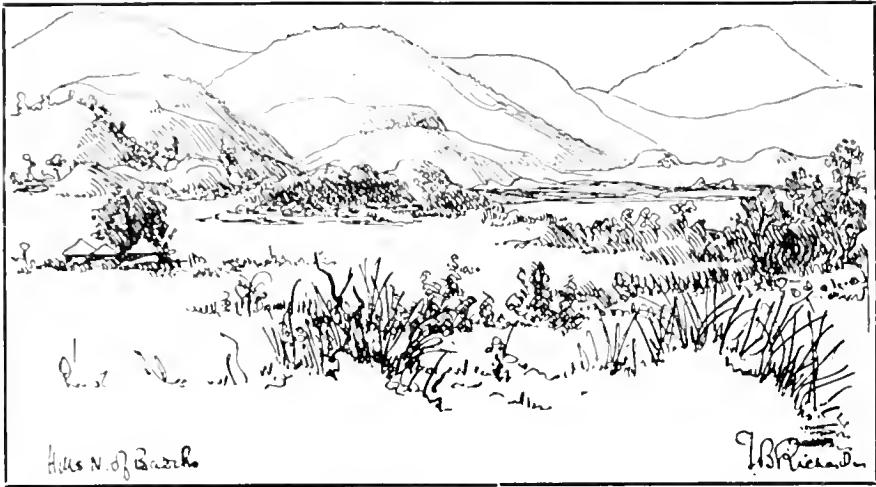
The crossing of a large caravan is a most remarkable sight. Two years ago only one small canoe was in use, so that many of the carriers followed the custom of crossing in huge calabashes, either sitting in this vegetal basin and floating down stream, slowly working their way across, or hanging on to the

calabash with their hands, and paddling across with their legs. If the water is high, it is a rapid stream, and the carrier finds himself halt a mile down stream by the time he lands, so that cases of unsealed provisions, books, and papers stand a poor chance of coming through unimpaired.

It is only a few miles from the Deleme to Badiko, which is a scattered town near the foot of a mass of bold granite—the Juga hills. Here there is a big road-side market, held under an immense tree and in rough grass sheds near-by. No town is to be seen, only a few scattered huts among a number of granite outcrops in the surrounding cornfields; but Badiko is a good sample of the towns in

down. In a country in which Europeans are so few it is not surprising that they should be hospitable, and it follows that the farther from the beaten track the more hospitable they become, for a white face with a cooling drink and soothing chatter is like a shady oasis in the bewildering desert of unsympathetic blacks, especially to the man who has been away alone in the bush for months together, with never a single word of his own language spoken, until he starts to talk to himself, or his horse, for company's sake.

From Badiko the track goes east, and descends steeply into the river-bed, and as steeply emerges on the other side, to continue over country broken by patches of bare rock and a



THE BADIKO HILLS.

this region, made up of collections of huts dotted over the country-side.

Two broad roads lead from Badiko, running nearly parallel to Tilde Fulani on the way to Naraguta, and the telegraph from Zaria to Bauchi runs through the market-place and through the compound of the rest-houses, which lie between the market and the river, called the Badiko, joining the Deleme a few miles north of the town. The European houses of the rest-camp are remarkable for the castellated enclosing wall, and for a double thick house-wall with only small windows, making an annular corridor round a dark, but dry, central chamber.

Badiko is on the road for the "tin white men" going to and fro from Naraguta and Ninghi, so that encounters are common. It is pleasant to come across another white man or strike a white man's camp on a lonely trek, especially to find someone already settled

number of small streams, passing through soft clayey ground cut through by rain torrents, where the local natives procure pure white kaolin to decorate their houses, always with the high ridge of the Juga hills a few miles to the north. Then it rises to meet the hills, which sweep round until they border the road at its junction with the track to Naraguta. At this point is Muchia market, one of the busiest on the road, in spite of the fact that there is no town near.

This market is always well filled, with cloth and leather merchants selling gowns and slippers, satchels and leather charms, with plenty of food-sellers from the villages and Fulani camps in the vicinity. At all hours of the day there is an incessant stream of wayfarers, a string of donkeys and their owners, bringing grain from Jar Bornu, a local farmer with a small flock of sheep and goats, a Fulani herdsman with a few head of cattle to sell for kill-

ing, and his womenfolk carrying a large supply of *nono** and butter. Customers are not lacking, for there are a number of mining camps within a few miles employing plenty of well paid labour, and Muchia serves as a meeting place for gaming and gossip.

In the market, squatting in the shade round the big tree-trunks and under rough sheds of grass, the women sell ground-nuts, rice (which is usually rather black), *utcha*, which is a

exposing their goods on the ground to the best advantage, and chattering busily among themselves. In the corner is a barber, with a curious collection of scissors, knives, and razors, rather blunt from our standpoint, and as he uses no soap but only water, not a very tempting opportunity. Next to him is a travelling *malum*, who acts as letter-writer and reader. He represents the priestly and educated class, and is referred to in disputes and



NEAR MUCHIA.

small grain grown by the hill pagans, rather like semolina when cooked, and balls of brownish dough, with a thin, evil smelling, yellow porridge made from guinea-corn. The butchers are busy killing and cutting up a beast, and a group of men are cooking strips of meat over a smoky wood-fire, and sticking them on a slip of wood, for all the world like cats' meat as purveyed in London. The cloth and leather merchants, metal-workers and sellers of charms, tobacco, cigarettes, and soap, sit back in their shady grass shelters,

* *Nono* is milk artificially soured.

can perform marriages. In his satchel he carries passages from the Koran, pens made from reeds, and paper brought from the East, by way of Kano, and an inkpot with red and black inks. The market is full of life and noise, with men, women, and children buying and selling, eating, and drinking, and all talking and gossiping.

In the stream close at hand a group of men are washing themselves and their garments quite publicly, and, in a place set apart for that purpose, one or two bearded and berobed old men are praying to Allah and his prophet.

After leaving Mucha there follows two miles of wild rocky scenery. The hills come down to the roadside and overhang the track, which winds in and out among huge boulders and huge trees, through whose interlacing boughs is seen curve after curve of bare granite sloping away hundreds of feet above.

The narrow landscape widens for a space where the well timbered Juga valley stretches away to the north, a good six miles to the Juga camp, with the wonderful Nafuta gorge beyond, and then goes on eastward again under the shadow of the hills to the far side of the valley, until it ends abruptly in a bare steep slope of smooth worn rock, which leads down to a wide fertile plain, hundreds of feet below. The outlook from the top of this precipitous slope affords a wonderful view. The traveller looks down upon a broad plain, with farms and trees in miniature, and silver threads of streams winding about the plain. To the left are still the Juga hills, half-covered in trees and grass, rising steeply out of the plain below; to the right, in a sweeping curve, are the hills that separate this little tableland from the one above it; and ahead, a day's journey to the east, are the Dass hills, which are almost comic in the curious variety of outlines they afford, columns and spikes and quaint curves. They call to mind a highly erratic temperature curve as portrayed in a text-book on physics.

The bare slope of granite is too steep for a horse and rider, and in wet weather it is quite a strain for anyone except a bare-footed nigger, and is always a slow and tedious descent. Across the middle of this plain flows the Jaroa river, and on its banks is the town of Polchi, an important half-Hausa, half-pagan town. From here through Jemaan it is only a three days' trek to the huge market town of Bauchi, the name of which indicates the principal occupation and source of income of its old rulers. It was pre-eminently the place for slaves; in fact, the Bauchi slave-market was one of the biggest in the world, and supplied Mahomedan races thousands of miles. The emirs of Bauchi found themselves situated on the edge of a huge mass of highlands, traversed by ravines, and river-valleys thickly populated by primitive races, for the most part cannibals, so that it is not to be wondered that they persistently raided the pagan settlements for slaves.

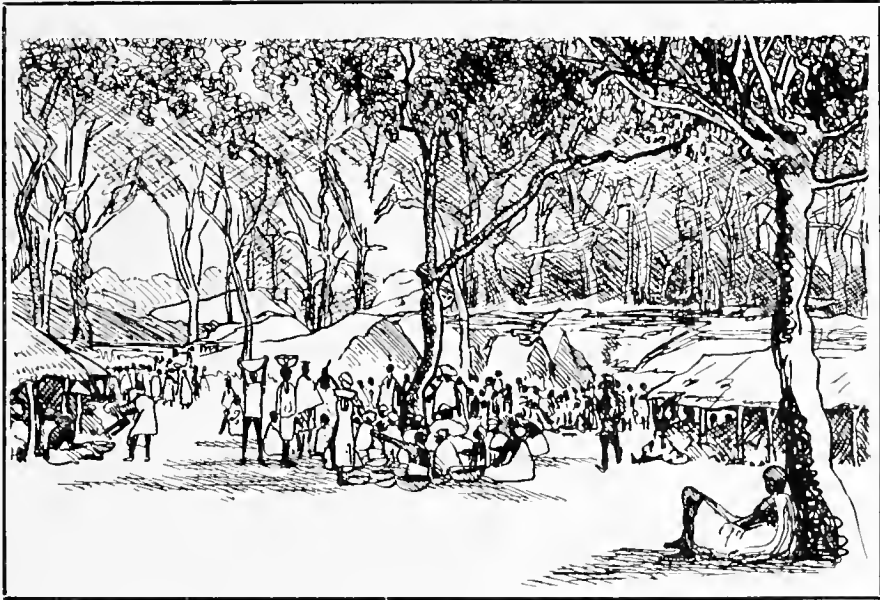
The pagans are by no means of one race; they are of many different races, and even different types, speaking distinct languages, and each tribe with its own peculiar customs

and physique. The segregation of tribes in patriarchal communities, among comparatively inaccessible mountain villages, seems to keep the races pure. It would seem that in this small tract of country, the plateau and the surrounding hills, there are the remnants of from thirty to forty nations. Whether they are the original inhabitants, or whether they were driven from the plains, does not seem to be known, but the fact remains that in and about the Bauchi highlands there are all these distinct races, who do not understand each other's tongues and have no common language; each has its own curious customs and habits, many are, or were, cannibals; and they differ as much in physique and type as the Scandinavian and the Turk.

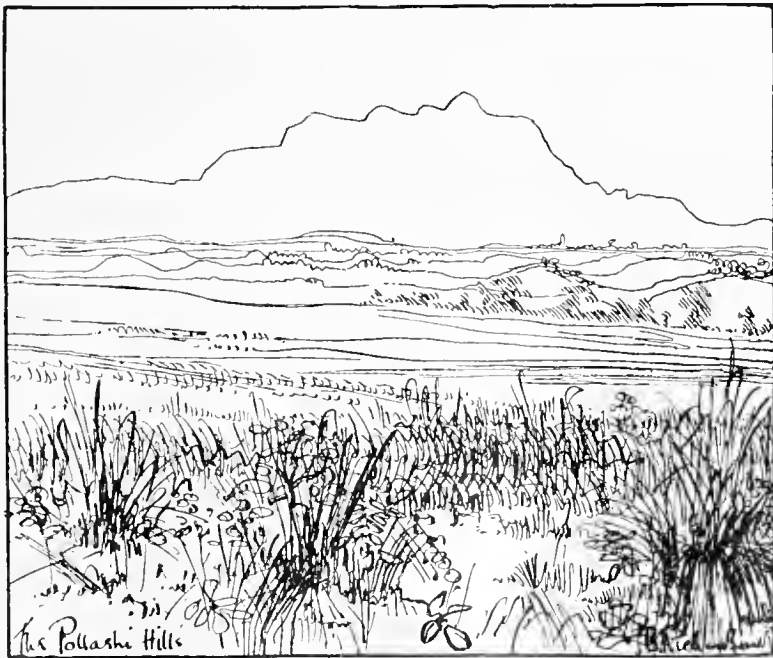
In the valleys and table-lands, of course, the Hausas and Fulanis, the conquering races, have to a considerable extent mixed and bred with some of the pagan tribes. The result is a race of semi-pagans, who are excellent farmers, living in small communities, and growing a considerable variety of crops in an industrious manner. Until recently, when it was suppressed by the British, there was a considerable trade in slave-catching, and there exists naturally a great hatred between the pagans and Hausas and Fulanis.

From the point of view of labour, for mining or other purposes, there is no doubt that the pagans are the more efficient. They seem to be vigorous, honest workers, and, unlike the Hausa or Fulani, do not slack off as soon as the overseer's back is turned. The semi-civilized Hausas, practising a feeble form of Mahomedanism and with a Semitic strain in their veins, are as cunning and crafty a race as can be. Lazy to a degree, their whole scheme in life is to get out of as much work as possible. If they are digging a trench, they will keep up a noise and simulation of great energy as long as they think you are within earshot, but as soon as you are well away they at once sit down to chatter and slack. If they are tin-working on tribute, they will be up to every possible trick to make a good show, so as to get into your good books or to earn more money to gamble with, for they are cursed with a great love of gambling.

If your labourers are Hausas and Fulanis you have to keep your eyes wide open all the time, as they will steal your cleaned tin ore and bring it back mixed with sand the next day with superb impudence, and if they are discovered they will take a big beating with the greatest stoicism, in fact, they would



MUCHIA MARKET



The Pollashi Hills

THE POLLASHI HILLS

rather have a dozen strokes than be fined a *toro** or bit of silver.

The pagans, on the other hand, although they may seem a bit shy and timid and therefore unintelligent, are really honest workers. If you want a road made and you have made a contract with a pagan headman, you will wake next morning to see a large crowd of naked savages armed with weird implements of iron and wood. With a few preliminary shouts and chatter they start off and soon set up a huge cloud of dust, which will last all day, and when the cloud clears away there is your road, or clearing, or whatever it was you wanted. The only inconvenience with pagan labour is the fact that if they are in the middle of a most exacting task, half-way through a building contract that must be concluded within a certain period, and it happens to be the date for a big feast or the time for some important agricultural task, sowing or cutting down the crops, then off they go, without a word and without their pay, and no more do you see of them unless you want them back. The pagan does not care for money at all, except to pay for his annual tax, which is a Government tax of a few shillings imposed on every male fit and old enough to work, but the wretched Hausa is keenly fond of his *kurdi*, that is, money, for gambling and for trifling luxuries.

The pagans on the hills, and also the semi-pagans in the valley, are purely agricultural. They grow enough corn and roots for their needs, and cotton if they wear clothes. They have no desire at all to work for the white man except just to make the small sum necessary for the tax. This probably applies to the peasantry of the whole country, for the labour spent on the farms is not great, and that falls mostly on the boys and women. As they can grow all they require for food and clothing with so little trouble, and have a small surplus most years to take to the local market and exchange for coloured cloth and baubles of all sorts, they cannot see any advantage in working long hours every day in all weathers, a state of affairs quite against their custom, disposition, and nature.

There was an effort made by a British syndicate a few years ago to induce the natives of Northern Nigeria to grow more cotton, so that the syndicate could buy the surplus at a price that would have given them a respectable margin of profit, but the native could sell each his tiny surplus at a much higher price

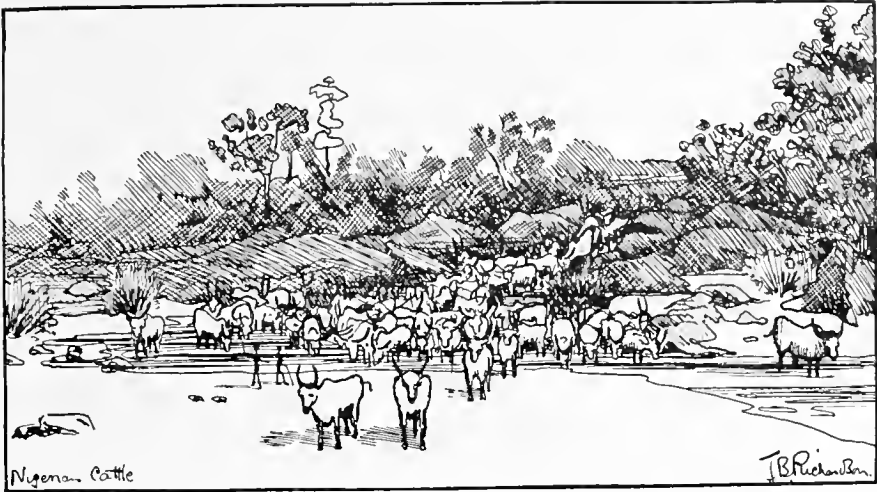
to his neighbours, and could see no reason for going out of his way to put a lot more ground under cultivation. Taken in all, the country is sparsely populated. A large portion of the land is virgin bush of a nature that is easily cleared, on which crops grow with hardly any trouble or attention, so that until the population increases tremendously, the natives will see no need to grow crops for a profit and bring in large surpluses to the white man's warehouses.

South of the Polchi plain lies the large and ragged mountainous mass of Jaroa, named after one of the biggest of the many pagan tribes, which, with its own curious ways and usages, keeps to itself in these hills. Only on rare occasions do they descend into the valleys in any number. Half-naked, with their potbellies and coarse brutal countenances, much disfigured with tribal marks, with bone pins like crochet-needles through the nose and earlobes, they seem somehow to suggest the cannibal of fiction. The men are large and lusty, and come down into the valley at regular periods of the dry season to hunt deer and any game they can kill. A band of two hundred or more will descend into a broad valley, and stretch a line of coarse strong netting, a mile or more long, erected on stout bamboos seven or eight feet high, at right angles to the river. Along the net, at about 50 yards from each other, are stationed warriors armed with short spears, bows, and poisoned arrows. The rest of the band go some miles into the bush, and form a big half-circle stretching away from the river, and then advance noisily and drive into the net all the frightened inhabitants of the bush. The buck and small deer are caught in the net by the horns, and shot or speared by the men stationed for that purpose. The usual catch never seems large enough to repay the effort of so many men. This tribe also hunts with the native yellow dog, which puts up guinea-fowl and other birds along the river-banks for them to shoot with their bows and arrows.

The Jaroa hills form the watershed of two large river-systems. The Deleme is fed by the many streams flowing to the north, and the Gongola by as many more from the eastern and southern slopes.

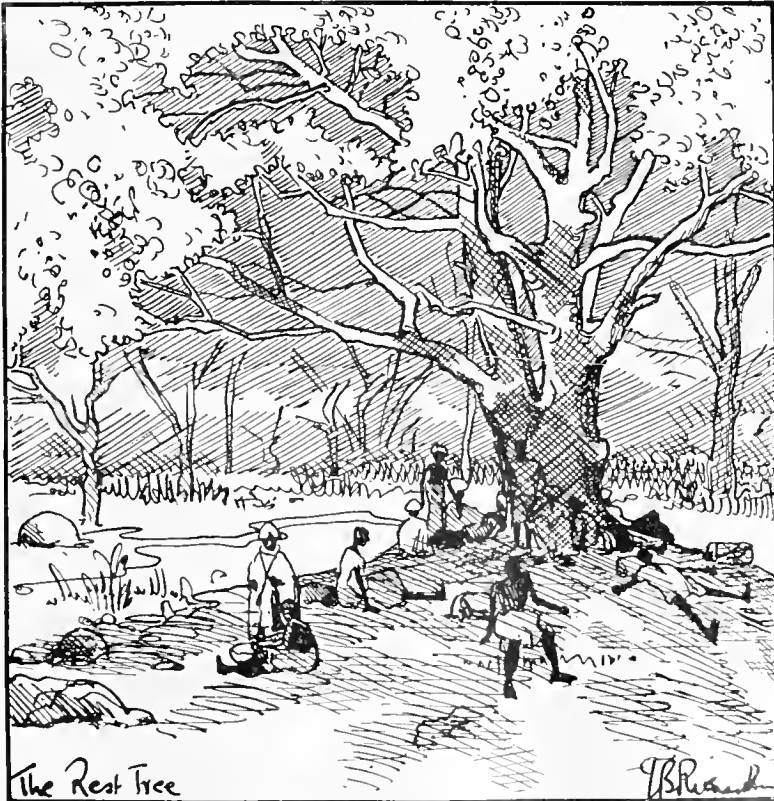
To the south-east of these hills stretches the Zare district, one of the first regions to be prospected for tin. Bordered to the north by the high ridge of the eastern Jaroas, it consists of a series of plateaus with innumerable small streams and low isolated hills here and there, not very thickly populated with pagans, whose

* *Toro* is a threepenny bit. English silver is current in Northern Nigeria.



Nigerian Cattle

NIGERIAN CATTLE.



The Rest Tree

THE REST TREE

women folk have a most peculiar salutation, a sort of shrill jodel ending with a nasal shriek, which they produce by pinching their noses. When this happens about a foot from your stirrup it is rather disconcerting. The cry is, in fact, the tribal cry of alarm to call the men back from the field in the case of a raid or attack. The reason that it became a form of salutation is told in the tale of a former Resident of Bauchi, who was greeted with this weird noise on his first ride through the market and took it as a sign of disrespect. After punishing the women, he decreed that hereafter the cry should be their form of salutation to the white man.

The descent from the Zare plateau in the wet season is reminiscent of Devonshire, with its leafy-scented shrubs and bubbling little torrents. There is a well defined edge to the Zare plateau, overlooking the valleys of the Kurдум and Leri rivers, which may be said to be part of the great plains stretching from the highlands. These two rivers rise in the plateau and flow eastward together, at some points only a few miles apart, and join, some sixty miles from their source, to form the Gongola. Both the Kurдум and Leri rivers were covered by prospecting leases, even three or four years ago, from their source nearly down to their confluence. They are the biggest rivers that flow eastward from the plateau, and both have quite a strong stream all through the dry season, and in the wet are roaring rivers. To camp near their banks then is like living close to a stamp-battery.

It was possible a year or so ago to take a three days' journey from Naraguta, across the river Jaroa, through the village of Murgi on the Gobellin river and the Zare plains to the Hausa town of Leri, a typical walled town of the plains, with palms and date-trees, and make every halt at breakfast, noon, and night on each of the three days at deserted prospecting camps, where engineers had spent patient months in finding out that the river-system that feeds the Gongola contains for the most part more iron than tin.

The Dila river, with its magnificent gorge and beautiful rapids, is a splendid example of the rugged beauty of the scenery round the plateau. The Shen valley and the river below the Bisichi property, both in the heart of the tin region, are near the source of the Dila, which river, like most Nigerian streams, unless they are unusually large, goes by the name of the nearest village. After passing below Bisichi, it descends into a broad plain, uninterrupted except by occasional low ridges

and isolated hills, with the one exception of the high arresting range of the Pollashi hills, which jut a thousand feet out of the plain behind Leri. The river flows by the ruined town of Kofia-n-Zare, where years ago there was a feudal tragedy enacted. It was once a prosperous community, receiving tribute from twenty surrounding towns and villages, but the *scraki* was such a tyrant, and demanded so many taxes from his people, and sold so many for slaves, that they combined and wiped the town out of existence, and were themselves extinguished in the process. There is now not a village for miles around, only the temporary huts of wandering Fulanis.

Between Kofia-n-Zare and the village of Kurдум, from which a stretch of the river takes its name, it approaches a range of hills, 200 or 300 feet high, and enters a gorge four miles long, in which one has to emulate the antelope and leap from rock to rock, jumping over dangerous holes and across boiling rapids. Occasionally there are waterfalls; one drops 60 ft. clear into a deep pool, with nearly perpendicular cliffs 300 ft. high. For most of the length of the gorge the sides slope steeply, with rocky ledges forming galleries infested with dog-faced baboons.

At the head of this gorge, after passing the village of Kurдум, there are broad sandy flats. Here lies the village of Bundas, sheltering under the high ridge of hills commanding a view along the wide valley below, where the lush river grasses grow and the Fulanis come when the feed is scarce elsewhere with their huge herds of humped cattle, and build a makeshift settlement of low grass huts shaped like a hive with a small low entrance.

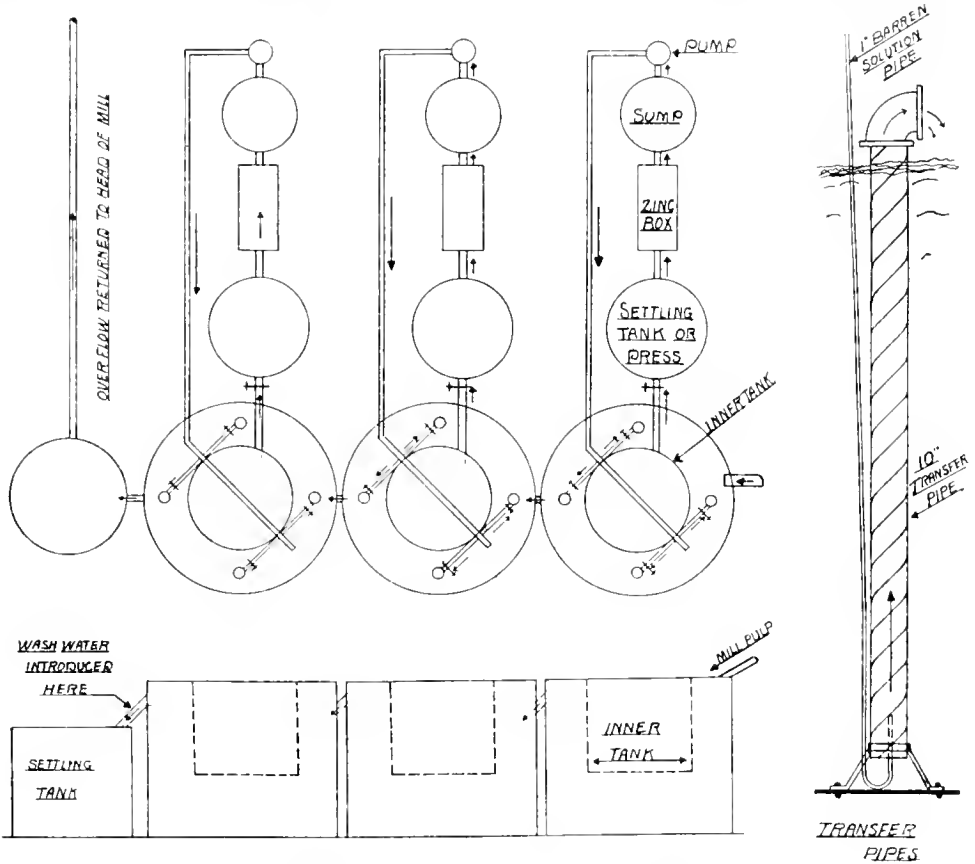
The cattle of Nigeria are like the humped cattle of the East, and are usually dirty-white in colour, with an immense expanse of horns. It is wonderful to see several hundred cattle being taken to water by a couple of naked children of tender years, armed with nothing but a small switch, yet they seem to have the most perfect control over the lumbering beasts.

The Fulani men and women are often handsome with straight aquiline features and fine upright bearing. They are usually light-skinned, some of them little darker than a Spaniard. Their hair is not so woolly as the Hausas, and the women especially dress their hair in a pleasing way, curling it, and adorning it with metal bands and rings. They also wear bracelets and anklets of brass. These petite, light-skinned, pretty-faced creatures are a great contrast to the coarse-featured, big-hipped, flat-nosed Hausa women.

PRECIS OF TECHNOLOGY

Spaulding's Slime-Agitation Method.—The *Mining and Scientific Press* for March 1 contains an article by C. F. Spaulding describing his system of continuous slime-agitation, whereby cyanide solution that has been freed from its gold in the zinc-boxes is pumped as a jet into the treatment vats in order to effect the circulation of the pulp. This method is in contrast with compressed-air circulation and mechanical agitation. Mr. Spaulding elaborated this method at the Veta Colorado mine, Parral, Mexico, and a plant with a capacity of 100 to 125 tons is being built on this system at the Ogle Mountain company's mine at Oregon City, Oregon. The vats resemble the Parral type, introduced by Bernard Macdonald at the

the inner and outer cylinders. The gold-bearing solution collects within the central cylinder, and the baffle-plates keep it quiescent. The solution is decanted through a 4-in. pipe, going first through a settling-tank or a press, and thence to zinc-boxes. The solution on losing its gold is pumped back through a 1-in. pipe to the bottom of the transfer pipes, and thus serving to induce the desired upward current. The slime passes from one vat to another, but the circulation of the solution is confined within the circuit of each individual vat. The inventor states that the contact of the barren solution with the pulp greatly accelerates the rate of dissolution of the gold. Also that the cost of pumping is much less than that of supplying compressed air. He estimates the power required for each vat at $2\frac{1}{2}$ to 5 hp, as compared with



SPAULDING'S SYSTEM OF SLIME AGITATION

Veta Colorado, and described in our issue of January 1912. The accompanying illustrations explain Mr Spaulding's method as applied at the new installation. There are three agitating vats each 20 ft. diameter, and 20 ft. deep, with flat bottoms. In each vat, circulation is effected through four 10-in. transfer pipes, fixed vertically 2 ft. from the vat walls, with elbow-joints at the top arranged to discharge the pulp tangentially. An inner cylinder without bottom is suspended in each vat, measuring 10 ft. wide and 10 ft. deep, and containing a number of baffle-plates. The discharge of the pulp tangentially causes a swirling motion between

10 to 15 hp. with compressed air. This method has not been patented. In most cases the system should obviate the use of mechanical filters.

Emeralds in Western Australia. The *West Australian Mining Journal* for February 8 contains an account of the occurrence of emeralds in the Poonah-Coodardy district, the tinfield not far from Cue, Western Australia, written by H. P. Woodward, for the Geological Survey. Large beryl crystals were found by prospectors in 1909, and A. Montgomery, the State Mining Engineer, presented one of them to the Public Museum. Mr. Woodward, while conducting a recon-

naissance of the tin district recently, made inquiries as to the source of these crystals. He ascertained that the discovery was made at a spot about a mile below the alluvial tin workings. Here the watercourse had cut through a m in central ridge of greenstone, and the beryls were found on the slope of the hill on the western side. They occur as green translucent stones, not of great size, the largest being an inch long by half an inch wide. They are not much worn, so the conclusion is that they have not travelled far. In fact it is supposed that their matrix is the rock below, and that the soil in which they are found is the decomposition product of this rock. Higher up the hill the exposed mica schist contains veins of pegmatite enclosing beryls, but though the crystals found there are large, they are as a rule of a much paler colour. Much prospecting has been done and many claims staked. Mr. Woodward is of opinion that a promising source has been found of emerald and aquamarine. The stones so far examined by lapidaries are irregular in colour, and full of flaws, so that the value of the discovery cannot be said to be proved.

Origin of Canadian Nickel-Copper Ores.—The quarterly bulletin of the Canadian Mining Institute for March contains a paper by Reginald E. Hore, on the origin of the nickel-copper ores of Sudbury, Ontario. Several different views are held on this subject. Most geologists believe that the ores originated in the same magma as the norite with which they are associated; some believe that the sulphides were concentrated from the molten magma by differentiation; while others hold that they were secondary deposits made by aqueous solutions which may or may not have been derived from the magma. Mr. Hore adopts the view that the orebodies are the result of a direct igneous process of concentration, and he proceeds to elaborate his idea of the process, comparing it subsequently with the description given by David H. Browne of the similarity of the furnace products and the original ore.

From A. P. Coleman's descriptions of the fused character of the conglomerate immediately overlying the eruptive sheet, with which the ores are associated, it is evident that when the magma had pushed its way out along the unconformable contact, it was still at a temperature much above that of its freezing point. It doubtless absorbed a large amount of the conglomerate, and it is likely that the light-coloured silicious upper part of the eruptive is due largely to such absorption. The extension of the norite far out from the main mass into comparatively narrow crevices in the surrounding rocks points also to considerable superheating. It seems likely that enormous quantities of heat were given off before any appreciable portion of the magma had cooled to a temperature at which solidification began. There was then this thick molten bed with its thin solid crust surrounded by rocks that were already highly heated. Further loss of heat must have been at a very slow rate and the time for differentiation in situ was undoubtedly enormously long.

So far as known, molten silicates are miscible in all proportions. Molten sulphides, however, will not mix in all proportions with molten silicates. It cannot be stated off-hand, therefore, whether the cooling magma would behave as one or as two or more solutions. From a consideration of the end products—the norite and orebodies—it seems to Mr. Hore that before solidification took place, the magma, with decrease in temperature, had separated imperfectly into two solutions. One of these was composed chiefly of the constituents of silicates and the other chiefly of the constituents of sulphides. Each solution contained a

comparatively small portion of the constituents of the other. The sulphide solution being heavier sank to the bottom. The process would be much like the separation of matte from slag with the essential difference that none of the furnaceman's precautions to effect a clean separation were taken. The proportions of the constituents not being the most favourable and no fluxes being added, the resulting solid does not show two distinctly separated portions. Not only was the boundary irregularly defined, but one solution in solidifying may have enclosed numerous detached portions of the other.

In each solution, moreover, there would be further differentiation as the necessary result of the fact that some minerals crystallize before the others. The first minerals formed would be found at the margins. On these, more crystals of the same composition would form and the composition of the remaining solution be thereby changed. Moreover, crystals forming early in any part of the solution, if of high specific gravity, would sink slowly. Since, however, at the temperature at which such crystals separate, the melt would be viscous, the sinking of crystals would be extremely slow. Some differentiation from these causes alone would, however, without doubt take place.

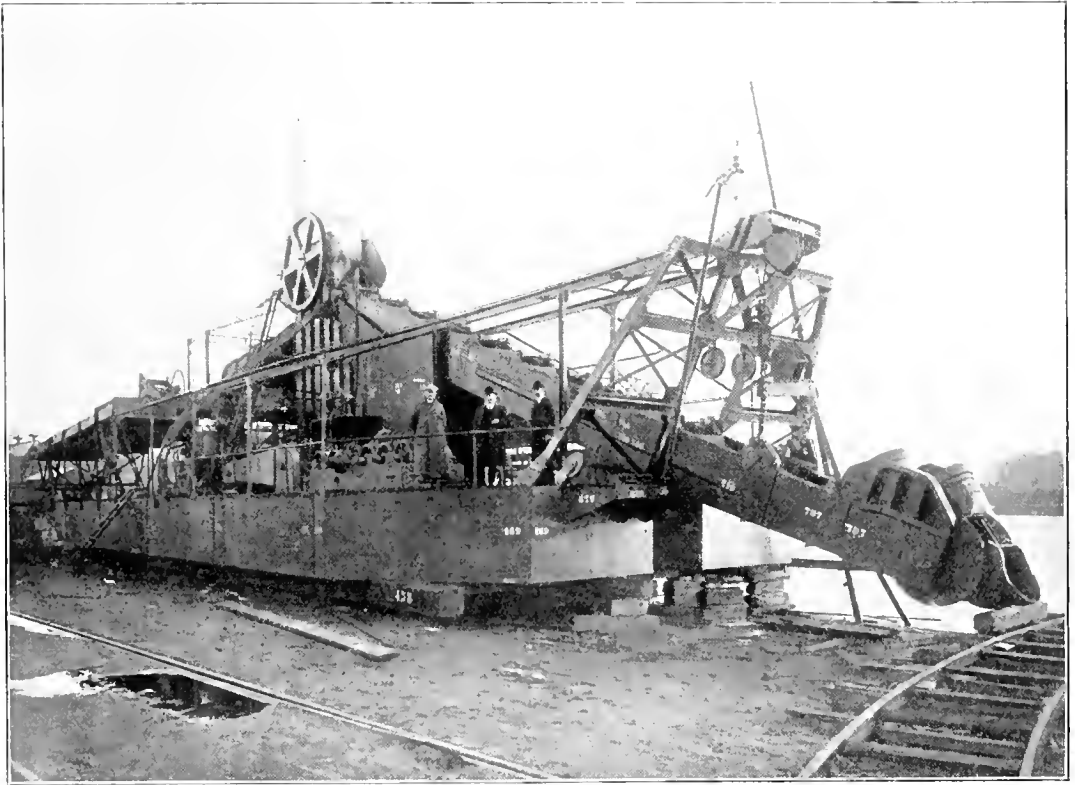
If the proportions of sulphides and silicates were such that their molten constituents were perfectly miscible under the conditions and no separation in the liquid state took place, there would certainly be some accumulation of sulphides in the lower part as the result of the crystallization phenomena just mentioned. It may be doubted, however, whether the ore deposits were thus produced. It is true that all gradations from solid ore to norite containing only a few scattered grains of sulphides occur; but compared with the thickness of the sheet the transition takes place in a remarkably short distance. Incomplete miscibility of the constituents of the magma and consequent formation of two solutions would be much more likely to result in the formation of such deposits. Imperfect separation of the two solutions, with resulting entanglement of large and small bodies of the other during the solidification, would explain the absence of a sharp line of division comparable with that obtained in furnace practice. Moreover, each solution contained some of the constituents of the other. Thus the silicate solution was saturated with sulphides, and on cooling below the temperature beginning the freezing interval, it is probable that the sulphides would be among the first formed minerals. If in the silicate solution there were any included bodies of the sulphide solution, there would be doubtless a change in the composition of the solutions in contact. After the main mass of the silicate solution became solid there would on further cooling be a second deposition of sulphides from the included solution. We would expect as a result of such processes to find, and we do find, large masses of norite specked with grains of early formed sulphides and with occasional patches of later formed massive sulphides, and from the sulphide solution massive ore with early formed silicates enclosed in it.

D. H. Browne, in his paper, gave a statement of relationships between ore deposits and furnace products. He stated that analyses of a pot of matte show marked tendency of the nickel to accumulate in the central part well toward the bottom. In the ore deposits a horizontal section shows increase in the ratio of nickel to copper toward the middle of the orebody. The output of the mines shows an increase in the ratio with depth. The marginal deposits show a greater ratio of nickel than do the off-set deposits. Analysis of slag

and matte show the ratio of nickel to copper to be greater in the matte than in the slag, and the same relation holds true for ore and the rock that is mined with the ore. One reason, doubtless, lies in the fact that molten nickel sulphide is more mobile than the copper sulphide and that therefore a greater proportion of the former would settle out from the mixture. The relative solubility of the molten sulphides in the molten silicate solution is an unknown but probably less important factor.

The analogies which Mr. Browne has shown to exist between the ore deposits and the furnace products strengthen the view that the deposits were formed directly from a molten magma

diameter. The tables are 8 in number, 2 sets of 4 each on each side of the dredge, having a total area of 1100 sq ft. Adjustable riffles are placed 6 ft. apart. The gravel in its passage down the tables is stirred by hand; so as to obtain an effective separation of the tin; mechanical means have not proved satisfactory. The tailing is discharged by a bucket-conveyor, 35 ft. long, from the stern. Water-ballast is pumped into and out of tanks in the stern underneath the tables so as to maintain the vessel in trim; for when the tables are loaded with concentrate the additional weight may be as much as 50 tons, and the position of the tables as regards the horizontal has to be the same as after a clean-up. Power is supplied by Diesel oil-engines.



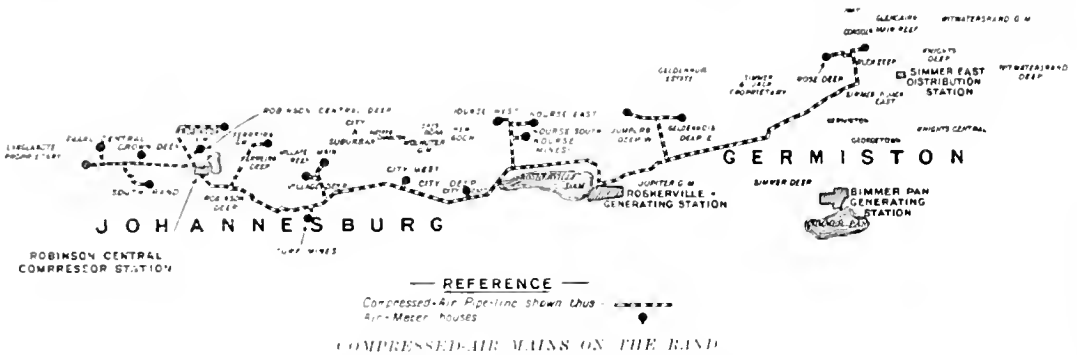
TIN-DREDGE FOR NIGERIA.

Tin-Dredge for Nigeria.—*Engineering* for March 14 contains an article describing a tin-dredge made by Werf Conrad for the Jos Tin Area, Limited, and it is in fact the first bucket-dredge to be sent to the Nigerian tinfields. The dimensions are: length 82 ft, beam 33 ft, depth 4 ft 5 in., and draught 2 ft 9 in. The hull consists of two steel pontoons, divided into water-tight compartments by means of bulkheads. The bucket-ladder is 60 ft. long between centres, and there are 40 buckets each of 4 cu ft. capacity. The top tumbler is square and the bottom tumbler hexagonal. The dredge will work to a depth of 25 ft. and will elevate to 15 ft. The capacity is from 40 to 55 cu ft. per minute. The structure and the machinery are sectionalized, so that the maximum weight is 3 tons. The revolving screen is 14 ft. 6 in. long and 4 ft. 3 in.

Wolfram in Queensland.—In our last issue we gave a short reference to Lionel C. Ball's articles on wolfram in Northern Queensland, appearing in the *Queensland Government Mining Journal* for January. The February issue of that paper contains a detailed account of the Mount Carbine district, where the wolfram is disseminated evenly through the lodes, in contradistinction to the patchy occurrences at Wolfram Camp. The Mount Carbine deposits were known to early settlers. Small shipments were made in 1895 and 1897, but it was not until 1908, when a line was built to connect Mount Molloy copper mine with the main railway at Mareeba, that serious development was begun. The Irvinebank company was then acquiring control of the best properties. The first concentrator built by this company commenced

work in August 1911, and has since then regularly produced 2 tons of concentrate per week. The ore is found in composite fissure veins of pegmatite, formed in intrusive emanation zones in slate and schist overlying the granite batholith. The veins are roughly parallel, but frequently branch and converge. Thus it is that in the workings the veins are continually pitting out, yet overlapping veins are as often found within a few feet. In general there has been no replacement of the country rock, and the pegmatite is everywhere sharply divided from the walls. The veins vary in width from mere threads to 6 ft., but most of those that are being worked are less than 2 ft. thick. They usually consist of quartz and felspar, the former greatly predominating. Scheelite, molybdenite, and cassiterite are found in addition to wolfram, though in too small quantities to be profitable. The quartz is comparatively friable, and of the ore delivered to the mill 10% will pass through a $\frac{3}{4}$ in. grizzly. The battery contains two units of 5 stamps each, using 8 mesh screens. Each stamp weighs 1200 lb., and makes 98 drops of 63 in. per minute, the duty being 5 tons per day of 24 hours. Ten more stamps are in course of

hydro electric station at the Victoria Falls, but subsequent calculations proved that the local coal deposits would provide a cheaper source of current. Some of the plants of existing power companies were purchased, and the erection of modern installations was commenced. Shortly after, the rival enterprise of Lewis & Marks, for a generating station at Vereeniging, was absorbed. At the present time, there are three stations on the Rand, at Brakpan, Summerpan, and Rosherville, while the Vereeniging current joins the system at Robinson Central. The Summerpan plant is in the neighbourhood of Summer Deep and Knight's Central, and the Rosherville between City Deep and Jupiter. The present capacities of these stations are as follows: Brakpan, two 3000 kw. sets; Summerpan, six 3000 kw. sets; Rosherville, five 10,000 kw. sets; Vereeniging, four 10,000 kw. sets, a total of 114,000 kilowatts. The above plants supply current for ordinary power purposes. In addition, the Rand Mines Co. purchase current for the air compressors, taking all the supply of compressed air from these electrically-driven compressors. At the Rosherville, there are, in addition to the plant above-mentioned, six steam-driven turbo



erection. The pulp from the battery is delivered to an upward current classifier. The underflow is sent to a Card table, from which the middling, after being re-ground in a Wheeler pan, is returned to the classifier. The overflow from the classifier goes to a series of settlers, from which the coarser portions are sent to Krupp tables and Lubrig vanners. The middlings from all these tables are returned to the upward-current classifier without re-grinding. The concentrates from the Card and Krupp tables are cleaned in a trough, and those from the Lubrig vanners in a kieve. During 1912, the amount of ore treated was 16,976 tons, and the yield 260 tons, so that the average extraction was about 33 $\frac{1}{2}$ lb. per ton. The concentrate is shipped to Germany for treatment.

Electric Power on the Rand. At the March meeting of the Institution of Electrical Engineers, A. E. Hadley read a paper on the electric power installations on the Rand, belonging to the Victoria Falls & Transvaal Power Co. The author traced the history of the undertaking, and showed how it had grown until at the present time the daily sales aggregate 1,350,000 units. The standard price for a 12-year contract is 0.525d. per unit, provided the consumption is not below a certain minimum. The consumers also have a rebate based on the surplus profits of the company. It is estimated that electric power has reduced the cost of power by 40%, and the cost of dressing and milling by from 6d. to 1s. per ton of ore milled. Readers will remember that originally it was intended to erect a

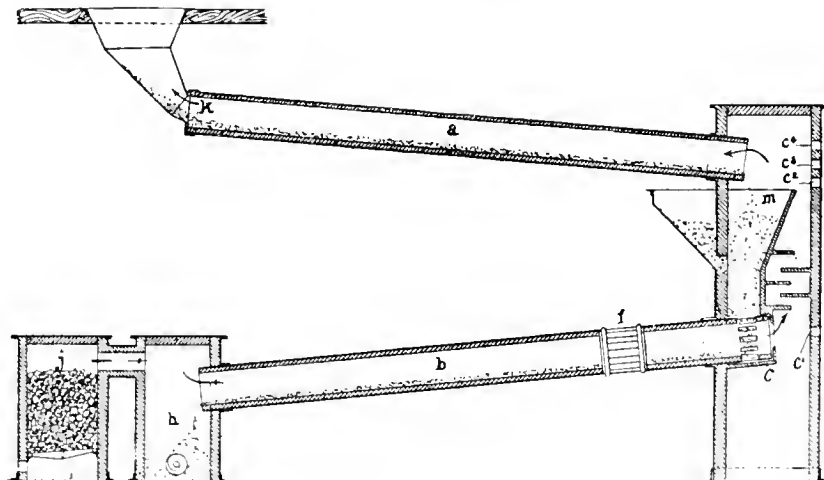
compressors rated as equal to 3500 kw. each. At Robinson Central a similar installation of equal power has been erected, driven electrically. As regards future extensions, work is already in hand to provide three steam-driven air-compressors, each equal to 7000 kw., at Rosherville, and 2 sets of 10,000 kw. generators at Vereeniging. The various generating stations are built on the same design, steam-turbines being used, and the generators producing current on the three-phase system. The main transmission lines carry current at 10,000 volts, except in the western Rand, where the distribution is at 20,000 volts. The lines from Vereeniging to the Robinson Central junction are worked at 80,000 volts. Customers are supplied at 2100 volts and at 525 volts, and the requisite transformers are provided by the power company. The air-compressor system is illustrated in the accompanying plan. The turbo-compressors are designed to take 22,000 cu. ft. of free air per minute each, with a discharge at 9 atmospheres. The consumers require air at 100 lb. per sq. in. The distance between the two extreme mines east and west is 11 miles. The total length of pipe is 20 miles, varying in diameter from 9 to 24 inches. Mr. Hadley's paper is lengthy and gives complete details of this great enterprise.

Sulphur in New Zealand. The *Australian Mining Standard* for February contains an article on the sulphur deposits on White Island, situated in the Bay of Plenty, off the north island of New Zealand,

and about 75 miles due west of Waihi. These deposits are found in the crater of an old volcano, the top of which constitutes the island. An attempt was made to work the sulphur in 1886, but the workmen deserted. The present enterprise is in the hands of the White Island Sulphur Co., and is directed by J. G. McGee. The crater is full of water and draining work is being undertaken. The last report to hand showed that the level of the water had been lowered by 17 ft., but that it was still 5 ft. above the sea. The unwatering operations have disclosed large supplies of sulphur. The volcano is still active, and new fumeroles are continually making their appearance. A wharf is being built, and a refining plant is being erected.

Alumina and Ammonia.—In our October issue we gave a short note on the Serpek process, for produc-

the temperature is maintained at 1800 to 1900°C. The resulting nitride is discharged into an air-tight chamber *h*. The nitrogen is produced in a gas producer *j*, and the mixture of nitrogen and carbonic oxide there evolved passes up in the opposite direction to the descending material. The carbonic oxide is subsequently mixed with air entering through the ports *c*₁, *c*₂, *c*₃, *c*₄, and is burnt in the upper kiln *a*, thereby effecting the calcination of the bauxite. Contact with water produces ammonia and alumina, and in practice aqueous solutions of acid would be used for producing a soluble form of ammonium compound. It will be seen therefore that this process yields a pure alumina suitable for the manufacture of aluminium, and also a fertilizer drawn from the atmosphere. The Serpek process is being developed in France.



THE SERPEK FURNACE.

ing alumina and ammonia, that is attracting considerable attention in America from the points of view of both producers of aluminium, actual and potential, and those interested in the fixation of atmospheric nitrogen. *Metallurgical and Chemical Engineering* for March contains reports of a number of papers on this and allied subjects presented at a joint meeting of the chemical societies in America. The most interesting was that by J. W. Richards. The existence of a nitride of aluminium was first discovered by Mr. Richards in 1890, when he found that dross from molten aluminium gave off a vapour smelling of ammonia on contact with water. Other investigators, notably Le Verrier and Mallet, have confirmed this observation, and have produced nitride of aluminium, AlN, as yellow crystals or amorphous drops, and have shown that on contact with water it is reduced to alumina with the evolution of ammonia. Serpek's researches have brought the matter farther forward. He found that, at temperatures about 1800 to 1850°C, alumina, when mixed with carbon and subjected to an atmosphere of nitrogen, rapidly formed aluminium nitride, while compounds such as bauxite would give the reaction at a slightly lower temperature. In practice Serpek uses two rotating cylindrical kilns *a* and *b*, such as are illustrated herewith. Bauxite is fed into the upper kiln, where it is calcined. In its passage from the upper to the lower kiln it is mixed with carbon at *m*. On its passage through the lower kiln it passes the electrical resistance *f*, by means of which

Efficiency of the Air-Lift.—*Metallurgical and Chemical Engineering* for March quotes a paper published by the University of Wisconsin, containing the results of an investigation, by G. J. Davis and C. R. Weidner, as to the mechanical efficiency of the air-lift. The advantages of this system of raising corrosive liquids have been known for a century, and of recent years the principle has been applied successfully in slime-agitation. Other methods absorb less power, but the advantages of the system are unquestioned. The paper gives information as to the history and development of the air-lift, showing that the principle was first used by Carl Emanuel Löscher, a German mining engineer, in 1797. The four types are described, namely, the side inlet, the annular air tube, the central air tube, and the combination (annular and central air tube). Among the disadvantages of the air-lift are its low hydraulic efficiency, 25 to 33%; the great depth of submergence required; its limited efficiency in horizontal pumping, and the aeration, which in some circumstances is a disadvantage, causing rusting of the eduction pipe and the deposition of salts in the foot-piece. The principal advantages lie in its large capacity, low maintenance-cost, low operating-cost, immunity from effects of high temperatures in the liquid pumped, and its reliability.

The variables that affect a particular size and type of pump are the following: (1) percentage of submergence; (2) lift; (3) discharge; (4) volume of air; (5) pressure of air.

The conclusions that may be deduced from the experiments are as follows:

The central air tube pump has the greatest theoretical capacity for a given size of well.

The coefficient of pipe friction and slip decreases as the discharge increases, and decreases as the ratio of volume of air to volume of water increases.

The coefficient of pipe friction and slip varies with the length of the pump, but seems to be independent of the percentage of submergence and of the lift.

The length of pump, the percentage of submergence, and therefore the lift, remaining constant, there is a definite quantity of air causing the maximum discharge. This quantity of air for maximum discharge, as also the ratio of volume of air to volume of water, differs for different percentages of submergence and lift, the length of pump remaining constant.

The length of pump remaining constant, the maximum output, for instance, foot gallons, occurs at about the same percentage of submergence for all rates of air consumption, being from 61 to 65% for the pump used in the Wisconsin experiments. At other submergences the output varies as the ordinates of a parabola having a vertical axis. Under these conditions the lift does not remain constant as the percentage of submergence varies.

The length of pump and percentage of submergence remaining constant, and therefore constant lift, the efficiency increases as the input decreases, that is, the higher efficiencies are obtained at the lowest rates of pumping.

By varying the percentage of submergence, and therefore the lift, the length of pump remaining constant, the maximum efficiency is obtained at approximately 63% submergence for all rates of input or discharge.

The lift remaining constant, the efficiency increases as the percentage of submergence increases, for all rates of input and all practical percentages of submergence.

With the same size and type of pump, the percentage of submergence remaining constant, the efficiency increased as the lift increased for the small lifts experimented on, that is, up to about 24 ft. From a theoretical study, however, the indications are that a point will be reached from which the efficiency will decrease as the lift increases.

Other conditions remaining constant, there is no advantage to be gained by introducing compressed air above the surface of the water in the well.

The type of the foot piece has very little effect on the efficiency of the pump, so long as the air is introduced in an efficient manner and the full cross-sectional area of the suction pipe is realized for the passage of liquid. Anything in the shape of a nozzle for increasing the kinetic energy of the air is detrimental.

A diverging outlet which will conserve the kinetic energy of the velocity head increases the efficiency.

Accessory Uses of Boreholes.—An article in the *Colliery Guardian* for March 28 draws attention to the many possible advantages of preserving all boreholes in mines, particularly those from the surface. The article is prompted by an instance of a preserved borehole being the means of saving life that happened at Egremont, Cumberland, where, at the Townhead mine, two men were imprisoned in the workings through an inrush of water which completely cut off exit by the shaft. These two men knew of a borehole to the rise of the shaft; they made their way to it and soon got into communication with the employers at the surface, who had also gone to the borehole. The

company's officials were able to converse with the imprisoned men, and they immediately made arrangements to send down through the borehole flasks containing hot drinks, food, &c., to say nothing of other comforts in the shape of candles, a watch, and such woollen clothes and wraps as could be safely put down a borehole 3 m. in diameter. The borehole was also used for pumping air down to the men. The men were imprisoned 8½ days before the shaft was unwatered and they could be brought to the surface.

Hitherto most boreholes have been lost through the mining companies or others not being prepared to purchase the contractor's tubing; the tubes have been withdrawn by the contractor on completion of operations, and then the boreholes collapse and are lost. In many cases a probable valuable asset is thus thrown away for the paltry cost of the tubes, an item of, say, anything from £10 to £100 according to the diameter and depth of the borehole. Apart from being used as a means of saving life, boreholes can be and are being used for water supplies and ventilating purposes, and as holes can be bored of a diameter large enough for a man to be lowered up and down, mining companies might consider making such provision where a second exit by shaft or other means does not exist. A borehole of such large diameter might have other uses. It could be utilized for lowering timber, a work of magnitude in some metalliferous mines which takes much time at the hoisting shaft. It could also be used for conducting electric cables to the workings, thus removing the danger of having them in the shaft. The question will no doubt be seriously considered in the future.

Hardinge versus Chilean Mills.—The *Bulletin* for March of the American Institute of Mining Engineers contains a paper by H. W. Hardinge on the results obtained by his type of mill. Among other things he gives details of competitive trials between his mill and the Chilean mill at one of the disseminated-copper mines in Utah, and shows that his mill yielded a more even product. The screen analysis shows that the Hardinge mill delivered 98.2% of the feed through 20-mesh, as against the Chilean mill with 66.2%. As regards the fineness of grinding, the Hardinge delivered 21.89% through 200 mesh, as against 45.49% by the Chilean. Thus, within the limits of products suitable for water concentration, the Hardinge mill yielded 76.7% of the feed in this form, and the Chilean mill only 36.3%.

CURRENT LITERATURE.

Measurement of Compressed Air.—The March issue of the bulletin of the Canadian Mining Institute contains a paper by C. H. Taylor, describing the methods of measuring compressed air supplied by the author's method of hydraulic compression to the Cobalt mines.

Sizing-Screens.—In *Metallurgical and Chemical Engineering* for March, Robert H. Richards discusses the various systems of standard screens for use in sizing-analysis, recommending the set made by the W. S. Tyler company, in which the linear apertures are in the progressive ratio of the square-root of two, the thickness of the wires being adapted to the requirements of manufacture. This ratio is Rittinger's, but we would draw attention to T. J. Hoover's system based on the cube-root of two, the ratio of volume of the particles and not the area of the aperture. Mr. Hoover's method was described in a paper read before the Institution of Mining and Metallurgy, and reference was made to it at some length in our issue of June 1910.

Hand-Sorting.—In the *Mining and Scientific Press* for March 15, R. S. Handy describes the experiments at the Bunker Hill & Sullivan lead mine, Idaho, which proved that hand-sorting was inadvisable under the particular circumstances ruling at that mine.

Concentrating Iron Ore.—The *Iron and Coal Trades Review* for March 21 contains an article by H. J. H. Nathorst, translated from the Swedish, describing the magnetic concentration of iron ore at the Gellivare mine, Sweden.

Grinding-Pans.—The *Monthly Journal* of the Chamber of Mines of Western Australia for January contains a paper by E. Jensen, giving the results of experiments with grinding-pans at Great Fingall.

Gold-Dredging.—In the *Mining and Scientific Press* for March 8, Charles Janin describes the proposed restrictive laws in California relating to the disposal of tailing in dredging operations, and recounts the regulations in the other countries where gold-dredging is an important industry.

Lluvia de Oro.—In the *Engineering and Mining Journal* for March 15, H. R. Conklin describes his work at the Lluvia de Oro mill, Chihuahua, Mexico. Owing to the gold-silver ore being much harder than expected, it was found necessary to re-arrange the plant. The ore is now all-slimes and cyanided, Nissen stamps and tube-mills being used. The continuous process of cyanidation has been adopted, with some modifications in detail. The barren solution is added to the pulp at each of the three middle thickeners and water at the last thickener. The overflow solution from the first thickener only is precipitated, the solution from the other thickeners making up the circulating mill-solution. This system requires a larger solution-storage capacity than the counter-current system, but the gain in extraction due to frequent changes of contact solution would undoubtedly more than counterbalance this item. The comparative results of the intermittent and continuous systems show that, at this mill, the continuous system is far superior. A notable feature is the method of transferring the pulp from one thickener to the next by means of barren solution and ejectors. Other cyanide operators may find in this a valuable suggestion. The possibility of obtaining intimate contact between barren solution and ore makes it worthy of consideration.

Refining Gold Slime.—In the *Engineering and Mining Journal* for March 22, Lyon Smith describes the process of refining gold slime produced at the Pittsburgh-Silver Peak mine in Nevada.

Lead Smelting.—The March issue of the *Bulletin* of the American Institute of Mining Engineers contains a paper by R. C. Canby, tracing the history and development of American blast-furnaces applied to the metallurgy of lead.

Determination of Zinc.—In the *Engineering and Mining Journal* for March 1, C. Offerhaus describes Voigt's rapid method of determining zinc in ore and slag, giving the results of his own experience with it.

Metal Filaments.—At the meeting of the Institute of Metals held on March 11, Alexander Siemens read a paper giving a history of the production of metal filaments, tungsten, tantalum, etc., intended for use in electric lamps.

Genesis of Disseminated Copper Deposits.—In the *Engineering and Mining Journal* for March 22, C. W. Botsford elaborates a theory explaining the formation of replacement orebodies of the disseminated-copper type.

Coal Storage.—In the United States much trouble is experienced in storing small coal. R. G. Hall, in the *Mining and Scientific Press* for March 15, des-

cribes his work in connection with storing fine coal at a zinc-distilling plant in Illinois. The coal is flushed into a pond, and when required is extracted by means of a centrifugal pump.

Fire-Clay in Canada.—The March issue of the *Bulletin* of the American Institute of Mining Engineers contains a paper by Heinrich Ries, describing fire-clay deposits in Canada, particularly in Nova Scotia, Quebec, Saskatchewan, and British Columbia.

BOOKS REVIEWED

American Mine Accounting. By W. H. Charlton. Cloth, octavo, 370 pages. New York: McGraw-Hill Book Co. Price 21s. For sale at the Technical Bookshop of *The Mining Magazine*.

This book is receiving a welcome in the United States, where nothing of the type has previously been published, most books or papers on the subject being confined to the explanation of individual systems of accounting. The English books on mine accounts are so little in accord with American practice as to be of no assistance. Mr. Charlton is a Michigan man, and he describes in detail several methods used at iron and copper mines in that district. He covers Utah practice in copper and coal mining, gives an example of Arizona methods, and details of the practice at the Portland gold mine at Cripple Creek. The book is to be highly commended.

The Cobalt Mining Manual. Compiled by H. Burges Watson. Pocket size, cloth, 70 pages, with map.

London: Straker Brothers. Price 1s. For sale at the Technical Bookshop of *The Mining Magazine*. This small book gives an outline of the operations at Cobalt, Ontario, with information as to the chief producing companies.

Geological Survey of South Africa, 1911, Part 111.

Quarto, paper covers, 120 pages, with maps and illustrations. Pretoria: Government Printing Office. Price 7s. 6d.

The third section of the report for 1911 of the Geological Survey of the Union of South Africa contains many interesting papers, of which that by E. T. Mellor in the Lower Witwatersrand System of the Central Rand deserves special notice. We regret to note that the index map of the Transvaal accompanying this report is hopelessly out-of-date as regards names of provinces, railroad communications, etc.

Map of the Nigerian Tinfields. By E. A. Langslow Cock. London: Waterlow & Sons. Price 42s.

For sale at the Technical Bookshop of *The Mining Magazine*.

This map of the Naraguta, Ninkada, and adjoining districts of Nigeria, has been prepared unofficially by the Government Inspector of Mines. It is a second edition of a publication that appeared in 1911, and contains up-to-date information of all the claims staked and the ownership. A book of 130 pages accompanies the map, giving the desired details. The scale is 4 miles to the inch, and the area covered is 25,000 square miles. Mr. Cock's labours will be greatly appreciated by all interested in Nigerian tin.

The Maikop Oilfields; Their Development and Possibilities. By Vladimir J. Winda; translated by F. F. Verschilde. Pamphlet, 40 pages with maps. London: *The Financial Times*. Price 2s. For sale at the Technical Bookshop of *The Mining Magazine*.

Mr. Winda is a Russian state mining engineer and geologist. His pamphlet gives a critical review of the activity and prospects of Maikop companies, and geological and location maps.

COMPANY REPORTS

Nigel Gold. The mine owned by this company is situated in the Heidelberg district of the Transvaal, on the southeasterly continuation of the Witwatersrand Series, and it is about 16 miles south of the mines in the far east Rand. The company is registered under Natal laws, and the head office is at Pietermaritzburg. Robert Carnow is manager. Milling started in 1888, and dividends have been paid regularly, except during

1913, 1914, and 1915, being at the rate of 10%. It is expected that the extraordinary capital expenditure will be entirely liquidated during the current year. Additional claims adjoining the Rand Nigel section of the property have been acquired. The ore reserve on December 31 was calculated at 178,765 tons averaging 6 dwt., and 627,551 tons below the latter is at present unprofitable.

Consolidated Mines Selection. This company was formed in 1897 as an amalgamation of the African Metals Co. and the Mines Selection Co., both of which were registered in 1895. In 1905, the Rand interests of A. Dunkelsbuhler were acquired, and in 1910 a subsidiary, the West African Mines Selection Syndicate, was formed for the purpose of conducting work in connection with the Wallis properties. The most profitable participation on the Rand has been in connection with the Brakpan mine. W. L. Honnold has since the beginning until last year been the consulting engineer to the group, and he is succeeded by C. E. Knecht. Mr. Honnold is now managing director at Johannesburg. The capital of the company is £552,500 in 10s. shares, the denomination being reduced from £1 to 10s. in July 1911, in order to bring the book value of the assets to their market value. No dividends were paid from 1905 to 1911. There are also outstanding £116,000 debentures. As has been the case with other African houses, the company has not had during recent years much opportunity for speculative dealings, and large amounts of money have had to be supplied for development of the properties. Now that Brakpan is making profits, it has been possible to resume dividends. The report for the year 1912 shows an income of £65,939 from dividends and interest, and £21,953 profit from the sale of securities. Expenses totalled £13,017, and £6139 was paid as debenture interest, while £55,250 is being distributed as dividend, being at the rate of 10%, and £15,000 placed to reserve.

Brakpan Mines. This company was formed in 1903 to acquire from the Transvaal Coal Trust the Brakpan gold property in the far east Rand. This mine was the first deep level in that part of the Rand, and it is the most valuable asset of the Transvaal Coal Trust and the Consolidated Mines Selection Company. As we have many times recorded, the property has been developed by two vertical shafts, one below the other on the dip. The plan on the opposite page shows the present state of development. Milling commenced in June 1911, and the first dividend was paid in 1912. The report now issued covers the year 1912. During this period, 738,108 tons was raised and sent, together with 17,310

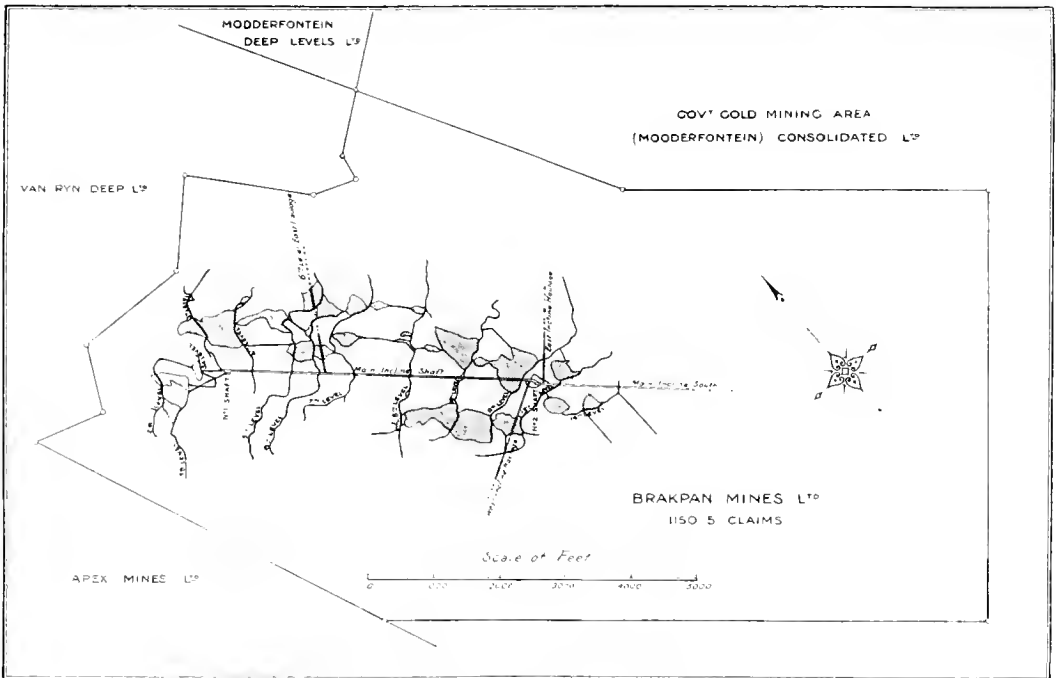


the war. In 1916 the number of stamps was increased from 55 to 75. The report now published covers the year 1912. During this period the stamps and tubemill were running continuously. The tonnage treated was 156,500, averaging 7½ dwt. per ton, and the total yield by amalgamation and cyaniding was 53,474 oz., or 6½ dwt. per ton. In addition, 13,450 tons of accumulated slime was treated, yielding 1558 oz. The working cost was 23s. 9d. per ton. The total receipts were £235,538, and the working cost £185,994. £379 was paid as profits tax, £14,334 written off for depreciation, and £3000 allocated to redemption of extraordinary capital expenditure. The dividends absorbed

tons from the dump, to the sorting station, where 15% waste was eliminated; 637,523 tons was milled. The average number of stamps running was 135 out of 160, shortness of labour causing delay in getting the full plant into operation. The yield of gold by amalgamation was 137,549 oz., and by cyanide 99,056 oz., a total of 236,605 oz., worth £995,623, being an extraction of 7.423 dwt. or 31s. 2d. per ton milled. The mining expenses were £355,162; allowance for development £47,814; and metallurgical treatment £114,885, being 11s. 1d., 1s. 6d., and 3s. 7d. per ton respectively. Adding head-office expenses, the working cost was £552,340, or 17s. 4d. per ton, leaving a working profit of £444,117, or 13s. 11d. per ton. Out of this, £48,728

issue of the report for 1912, news has been received that No. 1 shaft intersected the deposit at a depth of 3438 ft.

Transvaal Coal Trust.—This company was formed in 1889 to acquire the Weltevreden farm, afterwards known as Brakpan, in the far east Rand, and several purchases have been made subsequently. The gold deposits on the company's property were sold to subsidiary companies, the Brakpan and Springs. The Transvaal Coal Trust works the De Rietfontein and Oogies collieries, having suspended operations at the Brakpan coal mine in 1908. The report for 1912 now issued refers to the increasing difficulty of making the collieries in this district pay, owing to the poor quality



PLAN OF THE BRAKPAN WORKINGS.

was devoted to additional capital expenditure, and £41,953 was paid as profits tax. The shareholders received £300,000 as dividend, being at the rate of 40%. Development work to the extent of 17,348 ft. was done during the year, and the reserve on December 31 was 2,457,000 tons averaging 6.74 dwt. over 61 inches, an increase of 532,000 tons during the year, the assay-value continuing the same. The width of the 'reef' averages 31 inches, and its content 9.36 dwt. As already recorded, 40 additional stamps are to be added. It has been found desirable to increase the number of tube-mills, owing to a larger amount of pyrite in the ore than expected.

Springs Mines.—This company was formed in 1909 to acquire from the Transvaal Coal Trust an extensive gold-mining area in the far east Rand, to be developed as a 'fourth deep.' The direction is identical with that of the Brakpan mentioned above. Two 7-compartment shafts are being sunk 4500 ft. apart. The issued capital is £630,000. Of this, £300,000 was issued fully paid as purchase price, and 330,000 shares of £1 were issued at 30s. To date, £460,000 has been spent, chiefly in shaft-sinking. Since the

of the coal, as compared with that produced at Witbank and other parts of the Transvaal. The output of the De Rietfontein for 1912 was 141,840 tons, a decrease of 50,000 tons as compared with 1911. A better account is given of the work at Oogies, which is in the Witbank district. Here 324,602 tons was sold, or 19,109 tons more than in the previous year. Boring operations are being conducted on coal lands near Breyten, farther east, between Carolina and Ermelo. The accounts for the year show an income of £47,515 from the coal trade, and £101,400 from dividends on investments, chief of which is the Brakpan gold mine, in which company the Transvaal Coal Trust owns 253,000 shares, or practically one-third of the share capital. The dividend for the year was £109,152, being at the rate of 20 per cent.

Glencairn Main Reef.—This company belongs to the Barnato group, and owns a property on the outcrop in the middle east Rand. The grade of the ore mined is lower than that of any other worked at a profit on the Rand. Milling started in 1890, and dividends were first paid in 1894. After the war, dividends were not resumed until 1906, and the rate has been

comparatively small. The report for 1912 shows that 273,375 tons was sent to the sorting station, where 14% waste was removed. The mill of 160 stamps treated 236,685 tons of ore, from which 25,568 oz. gold was extracted by amalgamation, and 17,367 oz. by cyanide, a total of 42,935 oz., worth £182,500, a recovery of 3 6 dwt. or 15s. 5d. per ton milled. In addition 3421 oz. was recovered from accumulated slime. The working profit was £30,202, out of which £1180 was paid as profits tax, and £27,500 distributed as dividend, being at the rate of 5%. The reserve on December 31 was calculated at 205,418 milling tons, and J. G. Lawn, the consulting engineer, reports that there is also in the mine 1,111,164 tons of ore of doubtful profitability, of which he assumes that one-half will be worth working.

New Primrose.—This company belongs to the Barnato group, and owns an outcrop property in the middle east Rand. Milling commenced in 1889, and in 1895 the number of stamps was increased to 160. In 1912 the first tube-mill was installed. The report for the year ended December 31 last shows that 309,608 tons was raised, and, after the rejection of 9% waste, 289,000 tons averaging 7 13 dwt. was sent to the mill. The yield by amalgamation was 61,746 oz., and by cyanide 33,273 oz., making a total of 95,019 oz., being a recovery of 6 57 dwt., or 92% of the estimated content. The slime-plant treated also 38,022 tons of accumulated slime, from which was obtained 4451 oz. gold. The revenue from the sale of gold produced from current ore was £404,086, and the working cost was £201,655, leaving a profit of £202,428, the figures per ton being 27s. 11d., 13s. 11d., and 14s., respectively. A profit of £13,722 was made from the treatment of accumulated slime, and £4668 was received from rents and interest. The sum of £20,976 was paid as profits tax, and £5872 was allowed for depreciation. The dividends absorbed £178,750, being at the rate of 55%. It has been decided to add two more tube-mills and accessory classifying plant. The development done during the year included much work in the western side of the mine, and many patches of profitable ore were found; in addition, the old workings were reconnoitred, with good results in several sections. The ore reserve at December 31 was estimated at 413,033 milling tons, averaging 6½ dwt. The installation of tube-mills will make it possible to treat ore of lower grade, and the life of the mine, which in any case is short, may be prolonged.

Ginsberg.—This company belongs to the Barnato group, and owns an outcrop mine immediately to the west of the East Rand Proprietary. Milling commenced in 1891 and dividends were paid from 1897 to 1905, except during the war. In 1905 the mill was destroyed by fire, and in 1906 the plant of the adjoining Balmoral company was leased. The latter mine had not been worked for some time owing to discouraging developments. In the following year, the Ginsberg and Balmoral companies were amalgamated. The payment of dividends was resumed in 1908. The report for 1912 now issued shows that the addition of a tube-mill (none having been used there before) made it possible to increase the output and the recovery. The amount of ore sent to the sorting station was 248,849 tons, of which 32% was rejected as waste, and 167,922 tons, averaging 7 58 dwt., sent to the 80 stamps. The yield by amalgamation was 38,394 oz., and by cyanide 21,017 oz., making a total of 59,411 oz., worth £252,533. This was a recovery of 93.3% as compared with 91% the year before. The yield per ton milled was 7 dwt., or 30s. The working cost was £171,876 or 20s. 5d. per ton, leaving a profit of

9s. 7d. The sum of £6626 was paid as profits tax, and £10,186 was allowed for depreciation. The shareholders received £68,250, being at the rate of 32½%. As the supply of native labour has improved, a smaller proportion of machine drilling was done, this method is not advantageous owing to the steepness of the dip. Development during the year has given good results. A satisfactory feature is that in the section east of the north shaft the deposit dips more steeply than expected, so that there will be a greater amount of stoping ground before the East Rand dike is intersected.

Witwatersrand Gold.—This company owns the outcrop mine commonly known as Knight's, in the middle east Rand, and belongs to the Barnato group. Milling started in 1888, and was suspended from 1891 to 1896, during which time attention was devoted to exploration and development. The formation here is notable, for the original workings lost the deposit owing to reverse faulting, the result of the faulting being that the 'reef' is duplicated. The same is true in connection with Ginsberg and part of the East Rand Proprietary, immediately adjoining, and at other parts of the Rand. In 1910 a vertical shaft was started 3000 ft. south, in a deep level part of the property. The report for 1912 shows that this shaft intersected the deposit at a depth of 2232 ft. Though the first assays were disappointing, the subsequent drifts proved to be in profitable ore. During the year, 650,816 tons was raised, and, after the removal of 20% waste, 453,989 tons, averaging 6 13 dwt., was sent to the mill. The yield by amalgamation was 80,322 oz., and by cyanide 48,233 oz., a total of 128,555 oz., being 5 6 dwt. or 23s. 10d. per ton milled. The working cost was £336,076, or 14s. 7d. per ton, leaving a profit of £210,750, or 9s. 3d. per ton. The estate brought in an additional income of £20,643. Out of the profit, £44,250 was allowed for depreciation, £16,790 was paid as profits tax, and £148,750 was distributed as dividend, being at the rate of 35%. Development covered 10,008 ft., and disclosed 189,333 tons of ore. The reserve on December 31 was estimated at 1,331,540 milling tons containing 6 1 dwt. per ton.

East Rand Proprietary.—This company was formed in 1893 to develop the Farrar interests in the East Rand. In 1908 the whole of the businesses and properties of the subsidiaries formed in the meantime were re-purchased, the Driefontein, Angelo, Comet, and Cason being the leading producers. A change of direction and management was made in 1911, and the milling policy altered, by the rejection of a greater proportion of low-grade stuff. H. Ross Skinner is now superintending engineer, and W. T. Anderson general manager. During the year 1912, 820 stamps and 25 tube-mills were in operation. The ore raised totalled 2,054,507 tons, and after 10% had been rejected, 1,849,290 tons was sent to the stamps. The content of the ore delivered to the batteries was estimated at just under 8 dwt. per ton. The yield by amalgamation was 424,945 oz., and by cyaniding 280,380 oz., making a total of 705,325 oz., or 7 63 dwt. per ton. The revenue from the sale of gold was £2,967,442, or 32s. 1d. per ton milled. The working cost was as follows: mining £1,088,598, or 11s. 9d. per ton milled; development charges £277,207, or 3s. per ton; metallurgical operations £412,284, or 4s. 5d. per ton; general charges £150,259, or 1s. 7d. per ton; total £1,928,349, or 20s. 10d. per ton, leaving a working profit of £1,039,092, or 11s. 3d. per ton. In addition, 67,347 tons of accumulated slime was treated, yielding gold worth £54,665, at a cost of £17,011, leaving a profit of £37,653. The total working profit was therefore £1,076,746. Out of this, £45,891 was spent in

machinery, plant, and buildings, £48,920 on metallurgical plant, £21,281 on property, quarters, etc., and £99,592 on shaft-sinking and underground equipment, total £215,685. Profits tax absorbed £75,059, £68,712 was written off expenses of debenture issue, £73,667 was paid as debenture interest, £53,300 was devoted to the purchase of debentures, and £12,269 was subscribed to the miners' phthisis compensation fund. The shareholders received £611,474, being at the rate of 25%. The development work totalled 57,440 ft., and the ore disclosed was 1,774,631 tons, of which 1,029,106 tons was classed as profitable, averaging 8·2 dwt. per ton. An estimate of the ore reserve on December 31 was 6,013,300 tons averaging 6·8 dwt. There are also 8,166,327 tons of ore blocked-out averaging less than 4·3 dwt., the present pay limit. The most important new work during the year has been the resumption of sinking the 7-compartment vertical shaft at the Hercules section. This was sunk to 3018 ft. some years ago. The shaft was unwatered in April of last year and a plat cut at 3000 ft., from which it is intended to cross cut to the Main Reef Series on the horizon of the Cason 23rd level. The depth at this shaft at December 31 had been extended to 3937 ft. Development has been restricted in the Driefontein section, as it has been found that the Wit Deep dike, well known for its water, trends in that direction. It is intended to install an adequate pumping plant before sinking further in this district.

Cinderella Consolidated.—This company belongs to the Albu group, and was formed in 1910 as a consolidation of a number of deep-level properties, of which the Cinderella Deep was the only producer, to the southeast of the East Rand Proprietary. Progress of development was delayed by the fact that only one shaft had been sunk, whereas the government regulations call for two. It was intended to obtain a second outlet through Angelo Deep, belonging to the East Rand Proprietary, but suspension of work at that part of the property interfered with the plan. Subsequently connection was made, at the end of 1912, with the Cason shaft belonging to the same neighbour. The main shaft, called the 'West,' is vertical until it cuts the deposit, and thenceforward it follows the dip. Up to December 31 last the incline had been sunk 1163 ft., bringing the lowest workings to 4443 ft. vertically below the surface. Another vertical shaft, the 'Central,' is being sunk 5000 ft. to the east, and on December 31 had reached a depth of 2375 ft. The report for the year 1912 shows that the property has suffered considerably from shortness of labour, both in stoping and development. The reverse faulting on the 5th level also hindered the scheme of development, and the unexpectedly large influx of water in the Central shaft also delayed operations. During the year, an average of 75 out of the 100 stamps were running, together with 3 tube-mills. The amount of ore mined was 247,823 tons, averaging 6·32 dwt. per ton, and after the removal of 14½% waste, 211,518 tons, averaging 7 dwt., was sent to the mill. The recovery by amalgamation was 40,248 oz., and by cyanide 29,266 oz., a total of 69,514 oz., worth £294,213, or 27s. 10d. per ton milled. The working cost was £261,338, or 24s 8d. per ton. The accounts show a gross profit of £47,931, out of which £27,500 was paid as debenture interest, and £3340 as taxes, the remainder being carried forward. The development work amounted to 15,509 ft., and at December 31 the reserve was figured at 573,000 tons, averaging 6·7 dwt., and in addition 391,000 tons is returned as probable ore. Machine stoping has not been found satisfactory, and hand-labour is being substituted wherever possible.

The assay-values in the lowest workings are in general higher than those of ore hitherto found, and this fact has evoked a more hopeful feeling than was possible in connection with the ground developed at first.

New Rietfontein Estate.—This company belongs to the Barnato group, and owns a gold mine eight miles northeast of Johannesburg, on a fragment of a 'reef,' known as the Du Preez Series, parallel to the Main Reef Series, and believed by many geologists to be actually a dislocated part of that series. The present company dates from 1892, and several subsidiaries were formed, to be re-absorbed in 1905. Dividends were first paid in 1893, and have been irregular. The best period was from 1906 to 1909. The report for 1912 shows that 235,742 tons of ore was sent to the sorting station, where 19½% was rejected as waste. The ore sent to the mill, which contains 120 stamps and 3 tube-mills, totalled 189,287 tons, averaging 6·65 dwt. The yield by amalgamation was 39,696 oz., and by cyanide 17,460 oz., a total of 57,156 oz., worth £243,031, being a recovery of 6 dwt., or 25s. 8d. per ton milled. The working cost was £204,247, or 21s 7d. per ton, leaving a profit of £38,783, or 4s 2d. per ton. Income from the estate was £6087. The shareholders received £45,756 as dividend, being at the rate of 7½%. The results are almost identical with those of 1911. It has been found necessary to re-sample the mine on account of some of the blocks proving to be of lower grade than originally estimated. The reserve was calculated on December 31 at 135,887 milling tons, averaging 6½ dwt. There is also 260,214 tons of uncertain profitability. Much of the development work around No. 1 shaft has given disappointing results, owing to poor quality and to faulting. A bore-hole to the south of the dike passed out of the Witwatersrand system at 3068 ft., without having disclosed the presence of any auriferous conglomerate.

West Rand Consolidated.—This company, belonging to the Albu group, was formed in 1903 as an amalgamation of a number of properties in the far west Rand, and in 1907 it was consolidated with the Violet company. The share capital is £2,275,000, and there are £500,000 debentures. The only dividend paid was in 1908, when 3¼% was distributed. The property contains the Battery Reef as well as the Main Reef Series. The report for 1912 shows that 404,783 tons of ore was raised, and after the rejection of 17% waste, 334,420 tons was sent to the mill, which contains 100 stamps and 4 tube-mills. The yield by amalgamation was 67,751 oz., and by cyanide 40,002 oz., a total of 107,753 oz., worth £455,992, being 6·4 dwt. or 27s. 3d. per ton. The working cost was £381,287, leaving a profit of £74,704, or 4s. 5d. per ton. Out of the profit, £6984 was paid as profits tax, and £30,000 as debenture interest, the rest being carried forward. The more plentiful supply of labour has made it possible to push developments, and on December 31 the ore reserve was estimated at 1,116,733 tons, averaging 6 dwt. The developments on the Battery Reef have been particularly favourable, so much so that the directors are contemplating the erection of additional plant that will bring the total capacity to 700,000 tons per year.

Aurora West.—This is one of the companies owning outcrop properties in the middle west Rand that have not yet paid a dividend. Milling was started in 1892, suspended in 1894, resumed in 1899, only to be stopped by the war. A fresh start was made in 1908, with a new plant consisting of 60 stamps, which were increased to 80 in April, 1912. The control is with the Albu group. The report for 1912 shows that 192,522 tons of ore was raised, and, after the rejection of 19%

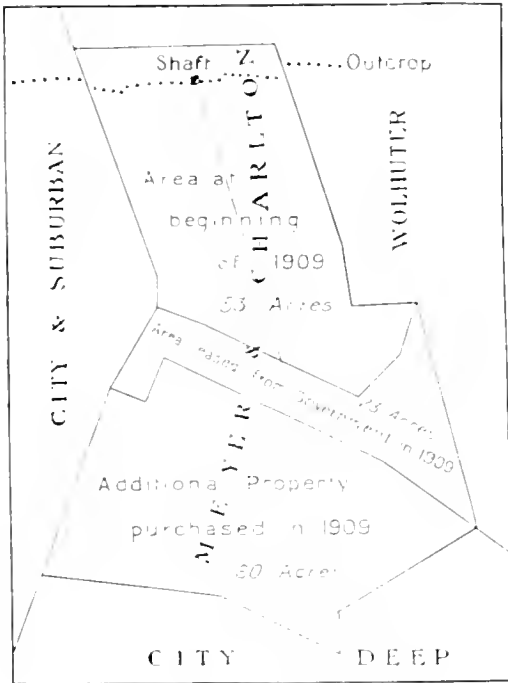
waste, 162,297 tons was sent to the mill. The yield by amalgamation was 32,038 oz., and by cyanide 15,534 oz., a total of 47,572 oz., worth £201,316, or 2s. 11d. per ton. The working cost was £160,239, or 19s. 8d. per ton, leaving a profit of £41,382, or 5s. 2d. per ton. Out of this profit, £11,847 was paid as interest on the loan of £156,112 advanced by the General Mining & Finance Corporation, and the remainder carried forward. In May, 1912, it was found desirable to write down the capital by changing the share denomination from £1 to 10s., and the issued capital now stands at 212,705 shares of 10s. each. The developments during the year have been encouraging, for the reserve has been increased by 121,486 tons of fully developed ore, and 73,119 tons of partly developed ore, the average content of both classes being estimated at 5.93 dwt. The figures for proved ore on December 31 were 467,061 milling tons, averaging 6 dwt., and 142,185 tons of partly proved ore estimated at 5½ dwt. The conditions are so favourable that there is a prospect of the finances being re-arranged by the issue of shares so as to retire the debt.

Meyer & Charlton.—This company owns one of the original outcrop properties in the middle Rand, though that property itself is practically exhausted; the life of the mine was extended in 1909 by the purchase of additional ground on the dip. The control is with the Albu group. Milling commenced in 1888 with 10 stamps, and the present equipment contains 75 stamps and 2 tube-mills. Dividends have been paid

a printer's error gives the average assay value at 7.17 dwt.) was sent to the mill. The recovery by amalgamation was 35,773 oz., and by cyaniding 43,385 oz., 36,960 tons of accumulated slime yielded 3845 oz., and 1620 oz. was extracted from concentrate. The total income from the sale of gold and from other sources was £361,581, and the working cost was £161,167, leaving a working profit of £200,387. Out of this, £40,280 was paid as profits tax and proportion due to the Government for undermining rights, and £11,086 was spent on equipment. The shareholders received £120,000 as dividend, being at the rate of 60%. During the year, 4937 ft. of development work was done, exposing 205,133 tons averaging 11½ dwt. per ton, and the reserve stood on December 31 at 363,548 tons, averaging 11 dwt. A year ago the reserve stood at 347,000 tons averaging 9 dwt. Judging by claim area, the prospective life of the mine is about 17 years.

New Goch. The mine owned by this company is situated in the central part of the Rand, and has had a chequered career. The control is now with the Albu group. It was not until 1909 that a profit was made. Dividends were paid also in 1910 and 1911, but owing to the fall in grade of nearly 1 dwt., no division of profit was possible for 1912. The report for 1912 shows that 411,803 tons of ore was raised, and, after the rejection of 21% waste, 324,369 tons was sent to the mill, which contains 120 stamps and 4 tube-mills. The average screen-assay was 5 dwt. The yield by amalgamation was 50,216 oz., and by cyanide 27,558 oz., a total of 77,774 oz., worth £329,252, being a recovery of 4.8 dwt. or 20s. 3d. per ton milled. The working cost was £271,572, and the profit £58,911, or 3s. 7d. per ton. Out of the profit, £8648 was paid as interest on debentures, and £22,900 devoted to the redemption of debentures. No dividend was distributed on the £550,000 shares. Developments in the lower levels are disclosing a rather higher grade of ore, and on December 31 the reserve was estimated at 957,571 tons averaging 5 dwt. per ton.

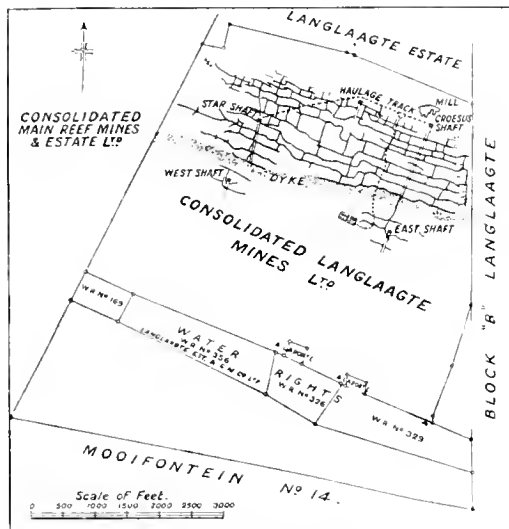
Roodepoort United Main Reef.—This company belongs to the Albu group and was originally formed in 1887. The property is in the middle west Rand. From time to time there have been many amalgamations and re-arrangements of holdings. In 1908 an amalgamation was effected with the Kimberley Roodepoort, and in 1910 part of the deep levels were handed over to the New Steyn Estate. The deposits have proved to be irregular and of low grade, and the problem of earning a profit has been difficult. Dividends were paid from 1894 to 1910, and the total distribution has been £609,500, on a capital now standing at £460,000. In order to carry out developments, it has been necessary to borrow £217,426 of new capital from the General Mining & Finance Corporation, the parent company of the Albu group. The report for 1912 shows that the ore milled has declined in content. The amount of ore sent to the sorting station was 439,008 tons, of which 17% was rejected as waste, and 362,439 tons was sent to the mill. Only 55 of the 100 stamps were at work. The yield by amalgamation was 57,860 oz., and by cyanide 28,418 oz., a total of 86,278 oz., worth £365,246, being a recovery of 4.76 dwt. or 20s. 2d. per ton milled. The cost was £325,460, and the profit £42,710, or 2s. 4d. per ton. Out of the profit, £15,054 was paid as interest on the loan, and the rest carried forward. The ore reserve on December 31 was calculated at 379,283 tons, averaging 5 dwt., together with approximately 100,000 tons partly developed estimated to contain 6.34 dwt. per ton. The reserve shows a decrease in tonnage during the year.



Plan of the Meyer & Charlton.

continuously since the beginning of operations. The year 1912 has provided a record profit, and it is also notable for a substantial increase in the tonnage and assay-value of the ore reserve. The amount of ore mined was 179,731 tons, and after the removal of waste, 168,970 tons averaging 9.17 dwt. (in the report

Consolidated Langlaagte. This company was formed in 1902 to acquire the properties of the Croesus and Langlaagte Star companies, on the outcrop in the west part of the central Rand. The control is with the Barnato group. In 1905 the shaft at the Star section intersected the Ferreira-Crown Reef dike, at a depth of 1657 ft., and subsequent exploration by bore-hole revealed the fact that the Main Reef Series was 1100 ft. nearer the surface on the south side of the dike than on the north side. Accordingly, a new system



Plan of the Consolidated Langlaagte Workings.

of development was adopted by means of two new shafts on ground acquired in 1908. A year ago it was decided to replace the old 140-stamp mill by a new mill of 100 stamps and 10 tube-mills, and the change was effected at the beginning of October. The report for 1912 shows that 290,036 tons was raised, through all four shafts. As the ground between the three 'reefs' contains gold, no sorting is done. The amount of ore milled was 295,072 tons, averaging 6.56 dwt. The yield was 56,632 oz. by amalgamation, and 32,978 oz. by cyanide, a total of 89,610 oz., worth £380,692, a recovery of 25s. 9d. per ton. The working cost was £281,246, or 19s. per ton, leaving a profit of £99,446, or 6s. 8d. per ton. In addition, a profit of £22,062 was made by re-treating 94,370 tons of accumulated slime. Out of the profit, £4500 was paid as debenture interest, and £23,329 as interest on the loan of £472,217 advanced by the parent company, the Johannesburg Consolidated, and the rest written off for the redemption of the balance of debentures, £75,000. A scheme will be placed before shareholders at the forthcoming meeting for the capitalization of the debt owing to the Johannesburg Consolidated. The ore reserve on December 31 was estimated at 2,069,630 tons, averaging 6.4 dwt., an increase of 847,000 tons during the year. The issued capital of the company is £732,679, and no dividend has yet been paid. For the accompanying plan we have to thank 'Mines of Africa,' by R. R. Mabson, published by *The Statist*.

New Unified Main Reef.—This company owns property in the middle west Rand. The control is with the Barnato group. The company was formed in 1891 to acquire the properties of the Eagle and National

companies. In 1892 the Edinburgh property was absorbed, and in 1894 deep-level claims were acquired. Milling was started in 1893, and stopped the next year, to be resumed in 1898. After the war, milling was re-started in 1903. The payment of dividends commenced in 1908. The report for 1912 shows that 161,735 tons of ore was raised, and, after the rejection of 18% waste, 132,100 tons, averaging 7.3 dwt., was sent to the mill, which contains 60 stamps and 1 tube-mill. The yield by amalgamation was 32,299 oz., and by cyanide 14,140 oz., a total of 46,439 oz., worth £197,215, being a recovery of 29s. 9d. per ton. The working cost was £140,724, or 21s. 3d. per ton, leaving a profit of £56,490, or 8s. 6d. per ton. In addition 12,995 tons of accumulated slime was treated and 1035 oz. gold extracted therefrom, affording a profit of £2791. The shareholders received dividends of £50,000, being at the rate of 20%. The tube-mill was erected at the end of 1911, and by its means the residue was reduced from 0.67 dwt. to 0.29 dwt., as well as the tonnage treated raised. Developments during the year have given satisfactory results, and it is now possible to mine larger amounts of the lower grade 'reefs' and to extract ore previously left behind. The ore reserve on December 31 was calculated at 275,028 milling tons, averaging 6.3 dwt. per ton.

San Francisco Mines of Mexico.—This company, just registered, is a second reconstruction of the San Francisco del Oro company, formed originally in 1903 to acquire a lead-zinc mine, carrying also silver and gold, situated 14 miles southwest of Parral, in the State of Chihuahua, Mexico. The present reconstruction has been arranged for the purpose of placing £200,000 debentures, the proceeds of which will liquidate debts and provide a working capital of £100,000. Knox & Allen, of New York, report that the San Francisco vein is a persistent fissure lode in limestone. Below the 3rd level the ore consists of sulphides. The ore reserve above the 4th level is estimated at 140,000 metric tons, and the expected ore between the 4th and 5th levels is given as 250,000 tons. The geological formation and the indications are such as to warrant the hope of a further 500,000 tons. The ore at present known assays 12½% lead, 17.4% zinc, 21 oz. silver, and 1.4 dwt. gold. The concentrating plant, consisting of jigs and tables, at present erected, has a capacity of 200 tons per day, but its action is imperfect and improvements are to be introduced. Eventually it is to be extended so as to have a capacity of 300 tons per day. When the alterations have been made, it is expected to produce a lead concentrate averaging 55% lead, 8% zinc, 60 oz. silver, and 4½ dwt. gold, which is saleable to local smelters; and also a zinc concentrate averaging 37% zinc, 8% lead, 22 oz. silver, and 1½ dwt. gold, which is to be roasted and shipped to the works of the Hydraulic Power & Smelting Company, in Norway, where it will be treated in the electric furnace.

Colombian Mining & Exploration. This company was formed at the beginning of 1908 to acquire a tract of country in the districts of Supia and Marmato, Colombia, containing a number of gold-silver mines and prospects. Operations have been centred on the Marmato Hill mine, which had yielded profits to previous owners. A number of mining engineers have examined and reported on the property, including Charles Olden, Llewellyn Parker, H. H. Knox, and Arthur Wilkinson. The last-named is now consulting engineer. The report for the year ended March 31, 1912, is now to hand, and shows that development has been actively pushed with promising results. The latest cable is to the effect that the ore reserve on

January 31, 1913, was estimated at 1,418 tons, averaging 18.5 oz. per ton, an increase of over 80,000 tons as compared with 12 months before. The old plant has been worked in a desultory way, producing during the year covered by the report gold worth £35,047 from 11,141 tons milled and 7885 tons examined, an extra ton of 208.66 per ton but only an incomplete recovery. A new mill, with a capacity of 9000 tons per month, is now on its way to the mine. On account of transport difficulties, all parts are sectioned as they go. The extraction problem has caused difficulties, as much of the gold is coarse, and in addition the pyrite content varies between wide limits. The new plant will not use amalgamation, and the ore will be slime and examined, with intermediate concentration to catch the coarse gold. In November last, 18,993 shares were issued at par, bringing the total capital to £1,000,000.

Mysore Gold. This company continues to hold its position as premier gold producer of India, and the developments show no sign of abatement in the ore reserve. The report for the year 1912 shows that 299,660 tons of ore was raised and milled, yielding 200,662 oz. bullion by amalgamation, 247,340 tons of tailing and 7476 tons of slime yielded 31,025 oz., and 75 oz. was obtained from cyanide slag. The total production was worth £404,074. The figures for tonnage and yield were records, being slightly above those of 1911. The current expenditure was £347,033, £51,277 was paid as royalty, and £26,836 as income tax, £25,000 was placed to reserve fund, which now stands at £125,000; and £50,850 was written off for depreciation. The shareholders received £381,250 in dividends, being at the rate of 125%. The experimental plant for slime-treatment has proved successful, and the construction of a large plant is now in hand. The great accumulations of tailing produced in earlier years are also to be tackled. The Edgar vertical shaft is to be sunk from 2000 to 4000 ft., and another vertical shaft is being sunk in McTaggart's section to meet the lode at about 2400 ft. The amount of exploration work done during the year was 30,262 ft., and the reserve was increased by 37,629 tons, standing on December 31 at 1,337,998 tons. The most interesting developments have been in Tennant's section, where much ore of high grade has been disclosed.

Nundydroog.—In writing a year ago, and also two years ago, of the results at this gold mine, belonging to the Kolar group in India, managed by John Taylor & Sons, we had the pleasure of chronicling record yields and profits. Bearing these facts in mind, the small decreases in yield and dividend during the year 1912, as disclosed in the report now issued, appear trivial, though on the other hand the recent developments give cause for anxiety. During the year, 100,552 tons of ore was raised and treated, yielding 80,140 oz. bullion by amalgamation and 7579 oz. by cyanide. The total yield was worth £330,937. The working cost was £140,154, royalty to Government £21,265, income tax £1237, depreciation of plant £10,409, additions to plant £12,752, allocation to shares appropriation account £10,000, and percentage of profit paid to the directors and managers £3537. The sum of £117,416 was paid as dividend, being at the rate of 41½%, the same as two years ago, and comparing with 45% last year. The metallurgical plant is being extended by the addition of re-grinding machines for the sandy tailing, and for the purpose of re-treating the accumulated sand and slime. The exploratory work during the past year has not been successful, as the work has proved to have been in poor zones, and in spite of 12,943 ft. of development, the

ore reserve in December was only 148,440 tons as compared with 160,593 tons the year before. It has been necessary therefore to reduce the monthly output to 7500 tons per month instead of 8300 tons. C. H. Richards, the manager, reports that the most recent developments in Kennedy and Richards' sections are much more promising.

Sudan Gold Field. This company was formed in 1901 to acquire prospecting licences in the Sudan, between the 20th and 22nd parallels of latitude, and eventually the Om Nahard mine was developed. The management is with John Taylor & Sons, and H. B. Williams is superintendent. The mine is about 300 miles further south than the Barrama, which belongs to the same group. The plant contains 10 stamps, and in the autumn of 1912, a cyanide annex was added. During 1912, the amount of ore raised was 16,847 tons, and after sorting, 14,826 tons was sent to the mill, yielding by amalgamation 9515 oz. of gold bullion. The cyanide plant treated 8755 tons of sand, yielding 981 oz. bullion. It is expected that a better extraction will be made as experience is gained. The treatment of the slime is under consideration. The total yield was worth £35,468. The working cost was £32,875, and £2038 was written off for depreciation. In addition, £5419 was spent out of capital on buildings and machinery. The development during the year has been distinctly encouraging, and the reserve on December 31 was estimated at 27,000 tons as compared with 13,000 tons the year before, and it is noteworthy also that the grade of the ore treated during the year was 2 dwt higher than in 1911. No dividend has yet been paid, and a reconstruction was necessary in 1908.

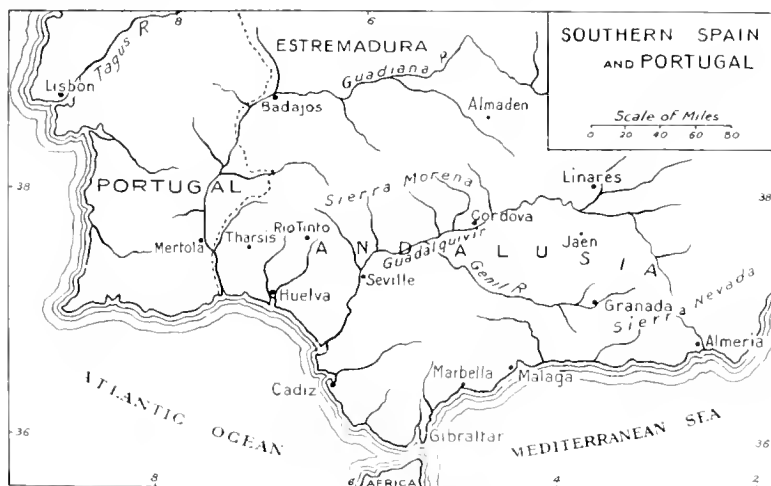
Cordoba Copper.—This company was formed in August 1908, as a consolidation of the companies operating the Cerro Muriano and North Cerro Muriano copper mines, situated 10 miles northeast of the city of Cordoba, in the south of Spain. John Taylor & Sons are the managers, William Frecheville is the chairman, and James Hocking is superintendent. The deposits are not easy to follow, and a large amount of development work is necessary. The dressing has also presented difficulties, and the Murex process has been adopted for re-crushed jig-middlings, other flotation processes not being suitable owing to the presence of calcite. The report now published covers the year 1912, and shows that in August a new blast furnace was substituted for the old one, with a capacity double of that of the latter. Additional Murex plant has also been provided, but has not yet started work owing to experiments being conducted with a new type of agitator. The amount of ore raised was 90,159 tons, a figure slightly higher than the previous year, and the production was 2377 tons of blister copper. Of the ore raised, some was hand-picked, and 55,013 tons was sent to jigs and tables. Some of the fine ore and fine concentrate was sintered and some briquetted. The Murex plant treated 8536 tons of re-ground jig-middling and tailing, averaging 1.73% copper, and produced 817 tons averaging 12.8% copper, the recovery was 70%. The smelter treated 24,477 tons of ore, concentrate, sinter, and briquettes, and produced 4595 tons of matte averaging 51.3%. Altogether, 10,236 feet of development work was done, but much of the ground was unproductive, and the ore disclosed was not quite equal to the extraction. The figure at December 31 was 200,025 tons averaging 3.35% copper. The cost during the year was rather greater than during the previous period, owing partly to the coal strike, and partly to abnormal rainfall. The accounts show an income of £166,593, and a profit of £32,280,

of which £36,578 was distributed as dividend, being at the rate of 20%. The average price obtained for the copper was £72 per ton. During the year 40,000 shares of 5s. each were subscribed at par, giving £10,000 additional working capital, and since the end of the year a portion of the balance of unallotted shares have been sold at a premium.

Rio Tinto.—The higher average price of copper during 1912 has enabled this leading producer in the south of Spain to distribute dividends at the rate of 90%, as compared with 52½% in 1911, 50% in 1910, and 60% in 1909. The trading profit from the sale of copper and pyrite, and from the working of the railway to Huelva, was £2,274,869, out of which £91,081 was allowed for taxes, etc., £103,976 was paid for administration, £150,669 written off for depreciation, £81,250 paid as dividend on the 5% preference shares, and

£250,000 was distributed as dividend, being at the rate of 20%. The company has a reserve fund in cash and securities of £1,161,805. No mention is made in the report of other properties in view. For some time investigations to this end have been made, but without obtaining just what is required.

Broken Hill South Silver Mining.—This, at the present time, is one of the three most successful companies at Broken Hill, New South Wales. The tonnage treated and the reserves are both expanding, and would do so in an even more marked degree if the supply of labour were adequate. The report for the half-year ended December 31 shows that 178,547 tons was raised, chiefly from the 970-ft., 1070-ft., and 725-ft. levels, comparing with 165,995 tons during the previous six months. The average assay was 13.7% lead, 13.8% zinc, and 6.4 oz. silver, as compared with



£1,678,500 distributed among the ordinary shareholders. The ore mined during 1912 was 2,406,969 tons, of which 698,399 tons was shipped abroad direct, and 1,708,570 tons delivered for local treatment in the furnaces and leaching floors. The amount invoiced for both copper and sulphur content was 688,861 tons. The deliveries of sulphur ore both raw and leached were 977,812 tons. The total copper marketed, either as metal or as content of ore sold, was 39,925 tons. All these figures show increases over those for 1911. The production of metal at the mine was 25,623 tons, the highest on record. The average copper content of the ore mined was 2.18 per cent.

Tharsis Sulphur & Copper.—This company has its headquarters in Glasgow, and operates the Tharsis and Calanas pyrite mines in the south of Spain. It was formed in 1866, and has paid dividends continuously. The total distribution to date has been £9,758,432, or 868% on the capital, and in addition practically the whole of the capital expenditure has been amortized. The report for the year 1912 shows that 33,480 tons was raised from the Tharsis, and 331,322 tons from the Calanas. The production on the spot of copper precipitate was 2408 tons, and 543,835 tons of pyrite, cupreous and washed, was shipped. The smelting works near Glasgow has been extended, and during the year 3377 tons of fine copper was produced. The company also sells purple iron ore, the residue after roasting at the alkali works. The profit for the year was £253,066, out of which

14.3%, 13.6%, and 6.5 oz. respectively. The lead-concentrator treated 180,080 tons and produced 27,238 tons of concentrate averaging 68.9% lead, 6.2% zinc, and 22.7 oz. silver, and 128,446 tons of zinc tailing, averaging 3.1% lead, 15.8% zinc, and 3.1 oz. silver. In addition, 17,661 tons of slime was produced, averaging 10.7% lead, 12.5% zinc, and 6.5 oz. silver. The current zinc tailing and 24,184 tons of accumulated tailing was delivered to the Amalgamated Zinc (De Bavay's), and 30,203 tons of old zinc tailing was delivered to the Zinc Corporation. The working cost, including mining, development, and concentrating, was 19s. 3d. per ton, a slight decrease as compared with the previous six months. The filling of depleted stopes called for 58,571 tons of material, of which 44,078 tons was tailing from the Sulphide Corporation's zinc-concentrator. Development work has given excellent results, and the reserve has been increased by 344,000 tons, bringing it up to 3½ million tons. The results at 1170 ft., the lowest level, are promising, and the exploration of the southern end of the property is giving excellent results. The company still has on hand over a million tons of zinc tailing to be delivered to the Zinc Corporation, and 51,047 tons bought by the Amalgamated Zinc; also 312,428 tons of slime. The accounts for the half-year show an income of £319,535 from the sale of concentrate, and £76,501 from tailing. The working profit was £222,022, of which £170,000 was distributed as dividend, being at the rate of 85% for the half-year.

Mount Bischoff Tin. The half yearly report for the period ended December 31 of the leading tin mine in Tasmania shows that the increase in the amount of ore treated recorded six months ago has been maintained. The tonnage mined was 131,028, of which 13,700 tons was rejected and 117,328 tons sent to the stamps. The yield was 600 tons of concentrate, equal to a recovery of 10½ lb. of black tin per ton. The figures for the previous half year were 600 tons and 10½ lb. The cost of mining and concentrating was £8.81 per ton milled, as compared with 48.7d. The company's smelting plant at Launceston treated 2065 tons of black tin, of which 617 tons was from the mine, and the remainder purchased or smelted as custom ore. The yield of metallic tin was 1422 tons, of which 404 tons came from the company's material. The black tin yielded 65% metal. The profit for the half-year was £49,798, out of which £39,000 was distributed as dividend, comparing with £12,836 and £36,000 respectively. £5713 was written off, and £1950 paid as income-tax. The distribution since the commencement in 1873 has totalled £2,068,000, on a paid up capital of £29,000.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

The New York Engineering Co. have recently published a collection of testimonials from the users of the Empire Drill in all parts of the world, confirming convincingly the many excellences claimed for this well known Prospecting Drill.

The British Aluminium Co., Ltd. are distributing announcements of their aluminium low-tension feeders and aluminium collector-bows. The use of aluminium in the equipment of modern electric traction systems, they claim, is increasing in view of its good wearing properties, low contact-resistance and high current-carrying capacity.

Cammell, Laird & Co., Ltd. have issued a pocket-size cloth-bound catalogue on tool steel. It is intended to assist the buyer in selecting the most suitable steel for the work. The little book contains some informative notes on annealing, forging, hardening, and tempering, as well as some useful tables. This firm's products vary from Super-Dreadnoughts to Pen Steel.

The Denver Fire Clay Company have sent us their 1913 Catalogue of Assayers and Chemists' Supplies. This is a handsome cloth-bound quarto volume of 525 pages, elaborately illustrated and containing complete information relating to the various apparatus and chemicals. The specifications for complete outfits for special purposes are helpful to the buyer. The physical and chemical reference tables are useful.

The Sturtevant Engineering Co., Ltd. have sent us catalogue No. 1511 on "Open Door" Rotary Fine Crushers, an inexpensive and convenient screenless type for reducing nearly all sizes and moderately hard rocks. The Sturtevant Newsgo Patent Screen Separator is described in booklet No. 1512. In their catalogue 1601 their well known Laboratory, Crushing, Grinding, and Screening machines are presented.

Fraser & Chalmers, Ltd. have prepared a series of leaflets describing Prospecting Outfits. These give complete information, with specification, price, weight, and weight. They include leaflets of Prospecting Stamp-Mill, Sinking Pump, Prospecting Hoist, Prospecting Core Drill, Assay Outfits for different fuels, Air-Drill

Plant, Empire Drill, Prospecting Huntington Mill Plant, and Copper Smelting Plant. Nearly all outfits are carried by them in stock, and prompt shipment can be made.

The Hardinge Conical Mill Co. reports that orders have been recently received for two Hardinge ball-mills and one Hardinge pebble mill, for the reduction of copper and tin ores. These machines are manufactured in England, the first two being for export, and the pebble mill for a copper mine in the north of England. The Dorr Cyanide Co., of Denver, have placed orders for one Hardinge ball mill and one Hardinge pebble mill, calling for both to be sectionalized to 250 pounds.

The Dorr Cyanide Machinery Co. have issued a new pamphlet which is especially notable because it contains a description of Mr. J. V. N. Dorr's latest invention, the Agitator. The machine is of similar construction to the Thickener, being a low flat bottomed vat, with slowly-rotating ploughs which draw the pulp to the centre, there to be elevated through a vertical pipe by means of an air-lift. The pamphlet also contains a description of the new model 'C' of the Dorr Classifier, which has an improved lifting device to raise the lower end of the rakes, so as to avoid draining the machine after a shut-down when heavily loaded. The improvement has been developed at the Tonopah-Belmont mine.

John Wells, of Cross Keys House, London, has issued a pamphlet describing the advantages of the Compayne power transmission method as applied to well-drilling and to hoisting in mines. The patents are controlled by Compayne Limited, of Victoria Street, Westminster. Power is transmitted from the power-plant to the place where it is required through the Hele-Shaw pump and hydraulic motor, oil being the hydraulic medium. This method is far more flexible and simple than spur-wheels and clutches, chain-wheels, or belts, and is therefore more adapted to a load that varies within wide limits. We regret that in a notice under this heading last month we did not give a correct explanation of the system and its application.

The Power & Mining Machinery Co., of Cudahy, Wisconsin, manufacturers of Mining, Smelting, Crushing, and Cement Machinery, have opened an office at 153, Queen Victoria Street, London, under the management of A. W. Cathin. In addition to a complete line of machinery for the usual requirements, the company has developed and introduced successfully the Mammoth gyratory crusher, with receiving openings ranging from 24 to 42 inches wide; the Mammoth jaw-crusher, with receiving openings up to 84 by 60 inches; crushing rolls 54 wide by 72 inches diameter; and the vertical "Great Falls" type of copper converter, having a diameter of 12 ft. The company is also licensed to manufacture the Peirce-Smith basic lined copper converter.

The Ingersoll-Rand Co.'s latest bulletins are on Power Driven Single Stage Straight Line Air-Compressors, Duplex Direct-Connected Electrically-Driven Air-Compressors, Duplex Steam-Driven Compressors, Temple-Ingersoll Electric Air-Rock-Drills, Chipping Hammers, Imperial Motor Hoists and Stationary Motors, Air Receivers, Pressure Fanks and Moisture Traps, Hodge's Fusible Signal Plugs, and the Leyner Drill Sharpener. This last named machine is specially interesting, not only for the amount and variety of work it can do, but also for the small space required for its installation. These bulletins make a formidable budget, but they are all of a size, and punched to fit a binding folder, which is well worth while keeping complete and up-to-date by those likely to require the efficient products of this company.

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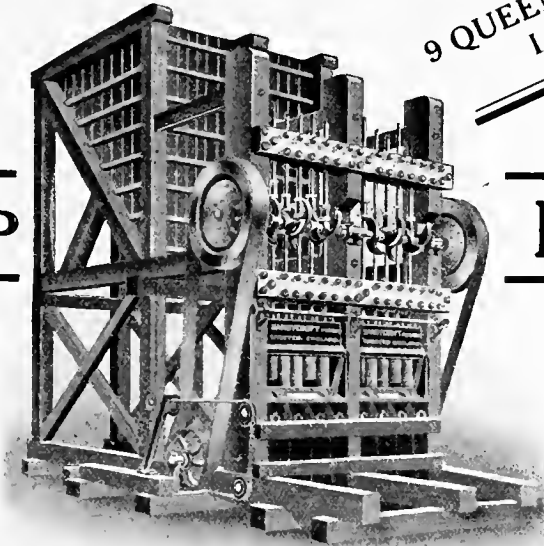
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COMPLETE MINE EQUIPMENTS

BRAKPAN MINES, LIMITED.

(Incorporated in the Transvaal)

EXTRACTS FROM THE REPORT OF THE DIRECTORS FOR THE YEAR ENDED
DECEMBER 31, 1912.

To be submitted at the Tenth Annual Meeting to be held in Johannesburg on May 27

THE capital of the Company remains unbanked at £750,000 in 75,000 Shares of £1 each, fully paid and issued. The Company's holdings also remain the same as at the date of the last report.

From the working expenditure and revenue account it will be seen that the profit from operations for the year amounted to

£444,117	1	9	
Add Interest, dividend on shareholding and sundry revenue	2,213	19	1
	£446,331	1	10

From which must be deducted depreciation and contributions to miners' phthisis insurance and compensation funds

3,595	19	1
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Leaving a net balance of revenue over expenditure of

£442,735	2	9
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Add Balance to credit of appropriation account at December 31, 1911

370	1	0
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Making a total available credit of

£443,105	3	9
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Against which the following amounts have been appropriated—

Expenditure on capital account	£48,728	4	7
Excess development	1,332	9	7
Government tax on profits	41,953	11	0
Dividends No. 1 and No. 2 (40%)	100,000	0	0

	£392,014	5	2
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Balance unappropriated as at December 31, 1912

£51,090	18	7
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In accordance with the policy foreshadowed by the Chairman at the last annual meeting, all capital expenditure incurred during the year has been provided for by appropriating a portion of the profits earned. It may be noted that of the amount appropriated under this head, the sum of £29,726 was in respect of the original equipment, the balance being in connection with certain additions to plant and machinery necessary in the light of further experience.

During the year the groups decided to merge their private recruiting organizations into a general body, known as the Native Recruiting Corporation, Ltd. This Company joined the new corporation and acquired the necessary number of shares. The item "native recruiting organization (Consolidated Mines Selection group of mines)" will therefore disappear from the next financial statements.

The Company's shareholding in the Witwatersrand Co-operative Smelting Works has been reduced from 1950 shares to 1219.

Technical matters are dealt with in the reports of your consulting engineer and general manager.

During the year special general meetings of shareholders were held for the purpose of amending the articles of association. The annual general meeting may now be held within six months of the close of the financial year instead of four months as heretofore. This alteration will enable shareholders in Europe to consider the annual reports and accounts before granting their proxies.

Two dividends have been declared during the year, viz.—

No. 1 of 15% on the issued capital of £750,000, absorbing	£112,500
No. 2 of 25% " " " " " " " "	187,500
	£300,000

Mr. W. L. Honnold, who since the formation of the Company acted as consulting engineer, resigned during the year, and was subsequently elected to a seat on the Board. Mr. C. E. Knecht has been appointed to fill the vacancy.

The vacancy caused by the death of Mr. J. G. Hamilton, the late chairman, was filled by the appointment of Mr. A. S. Pearce. Mr. W. L. Honnold was afterwards elected a member of the Board on the resignation of Mr. A. S. Pearce.

CONSULTING ENGINEER'S REPORT.

I have much pleasure in confirming the report of your general manager for the year ended December 31, 1912.

Operations resulted in 637,500 tons being milled, realizing a working profit of £444,117. The yield averaged 31s. 3 1/2d., and working costs 17s. 3 1/2d. per ton, while working profit was equivalent to 13s. 11 1/2d. per ton milled. The gradual improve-

ment in the supply of native labour made it possible to consistently increase the monthly rate of production from 11,060 tons milled in January to 60,000 tons in October. The advance in tonnage, apart from improvement in organization, was mainly dependent on the rate at which stopes could be opened out, the recovery, therefore, to prevent the average grade of all available faces working at full pressure. During the remaining two months of the year the tonnage receded somewhat, due to temporary power interruptions. Working costs—how a creditable improvement during the year, a net gain in this respect of 1s. 6 1/2d. per ton having been effected, notwithstanding the liberal policy adopted as to including items of minor equipment and other extraordinary charges. There is reason to expect further improvement during the current year.

Development footings totalled 17,98 feet, of which 12,619 feet were in reef averaging 9 1/2 ft. over a reef width of 37 1/2 inches. During the earlier months of the year development was somewhat restricted owing to insufficient labour, but, with improvement in this respect, the rate was so increased that by the end of the year a considerable tonnage in excess of that mined had been developed. The payable ore reserve at December 31, totalled 2,457,000 tons, of an average assay value of 6 1/4 dwt. Compared with the previous year's estimate there is an increase of 532,000 tons, the assay value remaining unchanged. Although essentially due to excess development, the gain in tonnage has to a certain extent been influenced by the general re-cast of the estimate after further experience as to breaking conditions. The reef width of the payable ore averages 39 3/4 inches, assaying 10 3/4 dwt. per ton, as compared with 39 06 inches averaging 10 05 dwt. at the end of the previous year, the estimated stopping widths being 61 inches and 58 inches respectively. On the present basis of sorting, and after allowance for the various factors involved, the value arrived at for the payable ore reserve is equivalent to an average recovery of about 30s. per ton milled. Needless to say working considerations may prevent this standard being consistently adhered to; moreover current development may influence the position.

The tonnage of unpayable ore standing in the mine at the end of the year is estimated at 1,806,000 tons, valued at 2 1/2 dwt. per ton. This represents the accumulation of ore so classed since the beginning of crushing, and is equivalent to 31% of the total tonnage developed to date. Certain areas classed as unpayable are of such dimensions as to call for additional exploratory work, and on further development are likely to add a considerable tonnage of payable ore.

The development suspense account, which showed a credit balance at the beginning of the year of £6644, was in debit at the end of the year to the extent of £1332. Working costs included a fixed charge of 1s. 6d. per ton milled for development, while the actual expenditure on this account was equivalent to about 1s. 2d. per payable mill-ton delivered.

During the year certain improvements underground have been taken in hand, the benefits of which will accrue later. No. 2 shaft station is being extended to accommodate traffic from the four haulage ways converging there, and two three-deck cages have been installed with a view to the more expeditious handling of labour, supplies and tools. Further expansion of the development and transportation scheme has called for the starting of two additional haulage ways, as well as the continuation of the eastern incline and main incline south. These are of double width, driven on line, and will be equipped with heavy rail and endless rope haulage. The 6th level east haulage feeds into the main incline and will eventually serve the northeastern section of the property, in the meantime dealing with ore from contiguous faces already opened. The other haulages deliver into No. 2 shaft station direct and will ultimately connect with laterals in the outlying sections of the property. All expenditure in connection with haulages has been charged to development. 11. — 21. —

In connection with surface equipment it was found necessary, owing to the excess of pyrite in the ore, to add to the tube-mill plant. Two tubes have already been added and two more are on order and should be in operation by the middle of the year. It is probable that the forty additional stamps, for which provision was made in the mill building, will shortly be ordered. These at first will be utilized as an alternative for tube-mills. The plant generally has run smoothly, reduction costs were low and the new features have proved themselves satisfactory in every way.

C. E. KNECHT,
Consulting Engineer.

SPRINGS MINES, LIMITED

*(Incorporated in the Transvaal).*EXTRACTS FROM THE REPORT OF THE DIRECTORS FOR THE YEAR ENDED
DECEMBER 31, 1912.*To be submitted to the Fourth Annual General Meeting to be held in Johannesburg on May 27.*

THE Directors beg to submit their report for the year ended December 31, 1912, together with a duly audited balance-sheet made up as at that date and the reports of the Consulting Engineer and the Manager.

The capital of the Company remains unaltered as follows

Issued capital, divided into shares of £1 each.....	630,000 Shares
Held in reserve	165,000 ..
Total	<u>795,000 Shares</u>

The issue of 330,000 working capital shares at 30s. provided the Company with a sum of £495,000 in cash. An option over 165,000 shares at 40s. matured on December 31, 1912, but was not exercised.

The Company's property continues to consist of all mineral rights in all precious metals and of all mynpacht and other mining rights on the farm De Rietfontein, No. 14, District Boksburg, to which the Transvaal Coal Trust Company, Limited, as owner of the farm, is or may become entitled, in all some 1160 gold claims, and of any rights which may ultimately accrue to the Company by virtue of an agreement with the Eastern Exploration Syndicate, Limited, which Syndicate was the original prospector of the property.

Most of the group private recruiting organizations were amalgamated during the year into one body known as the Native Recruiting Corporation, Limited. This Company joined the new Corporation, acquiring the necessary number of shares.

The item 'native recruiting organization (Consolidated Mines Selection group of mines)' will therefore disappear from the next balance-sheet; otherwise no change has taken place in the Company's shareholding.

Technical matters are dealt with in the reports of the Consulting Engineer and Mine Manager.

The agreement made with the Rand Water Board has been a source of considerable income to your Company. During the year 485,648,000 gallons of water were disposed of, the revenue received amounting to £6070. 12s. 1d.

The cash receipts and the expenditure to the end of the financial year were as follows:

RECEIPTS.

Working capital, 330,000 shares at 30s.....	£495,000 0 0
Interest and sundry revenue	39,000 17 10
Sale of surplus water	6,238 14 7
	<u>£540,239 12 5</u>

EXPENDITURE.

Transfer duty, etc.....	£9,776 6 8
Shaft sinking and equipment	430,300 13 2
General expenses.....	31,870 2 5
Balance, being cash and cash assets after deducting liabilities	78,292 10 2
	<u>£540,239 12 5</u>

Extraordinary general meetings of shareholders were held during the year for the purpose of amending the articles of association, and it is now possible to hold the annual general meeting within six months of the close of the financial year instead of four months as in the past. This alteration was made to meet the wishes of European shareholders.

Mr. W. L. Honnold having resigned the position of Consulting Engineer, Mr. C. E. Knecht was appointed to fill the vacancy.

Shareholders are asked to confirm the appointment of Mr. A. S. Pearse as a director in place of the late Mr. J. G. Hamilton, also that of Mr. W. L. Honnold in place of Mr. A. S. Pearse, since resigned. In terms of the articles of association Messrs. F. R. Lynch and W. L. Honnold retire by rotation, but these gentlemen are eligible and offer themselves for re-election.

CONSULTING ENGINEER'S REPORT.

I have much pleasure in confirming the report of your Manager for the year ended December 31, 1912.

In the North Shaft the amygdaloidal diabase was cut at a depth of 2444 feet, and was passed through at 2842 feet, the abnormal thickness being due to a repetition of the bed produced by reverse faulting. The depth to the reef will therefore exceed the original estimate. Sinking conditions below the diabase have been favourable, and the reef may be expected any day, probably not later than the middle of March.

The South Shaft passed through the Kimberley slates during the year and has now entered the amygdaloidal diabase. The relative depths of certain markers indicate that the reef will be cut in this shaft at a somewhat greater depth than previously anticipated.

C. E. KNECHT,
Consulting Engineer.

MANAGER'S REPORT

For the Year ended December 31, 1912

NORTH SHAFT.—The footage sunk during the year amounted to 1538 feet, or an average of 128.2 feet per month. The total depth at December 31 was 3110 feet. The six hoisting compartments have been equipped throughout with guides, and a 6 inch air main has been carried down with the sinking. The quantity of water at the 655 feet station decreased from 1,629,000 gallons per day in January to 850,000 gallons per day in December. About 7200 gallons are being handled daily below the station. The pumping plant has given every satisfaction and is in good working order, the only stoppages during the year being due to interruption of the power supply.

SOUTH SHAFT.—Sinking for the year amounted to 1549 feet, the monthly average being 129.1 feet. The total depth at the end of the year was 2850 feet. As at the North Shaft, all the hoisting compartments have been equipped with guides. The air main was also extended as sinking progressed. The quantity of water at the 903 feet station has decreased from 989,000 gallons to 650,000 gallons per day. About 12,000 gallons per day are being haled from varying depths below the station. One permanent high lift centrifugal pump having a capacity of 1,000,000 gallons per 24 hours has been installed during the year, and has given every satisfaction. The pumping plant generally is in perfect order.

GENERAL.—A Kaffir Location of 64 huts was erected during the year. All quarters and sundry buildings were maintained in good order. The Rand Water Board drew a total of 485,648,000 gallons of water, or an average of 1,330,543 gallons daily. The supply of native labour was equal to requirements, but efficiency was somewhat low owing to the large percentage of tropical natives, this class of labour not being the best for shaft sinking. In conclusion, I beg to call your attention to the excellent and loyal services rendered by the staff

B. D. BUSHELL,
Manager.

TRANSVAAL COAL TRUST COMPANY, LIMITED.

(Incorporated in the Transvaal)

EXTRACTS FROM THE REPORT OF THE DIRECTORS FOR THE YEAR ENDED
DECEMBER 31, 1912.

To be submitted to the Twenty first General Meeting to be held in Johannesburg on May 27

THE capital of the company remains the same as at the date of the last report, viz., £550,000 in 350,000 shares of £1 each, of which 545,760 have been issued, the balance of 4,240 being held in reserve.

During the year your Directors purchased a one-sixth undivided interest, in extent 1473 acres, in the coal rights of the farm Vaalbank No. 228, Carolina District, and acquired the prospecting rights over the undermentioned properties in the district of Breyten, with the right to purchase the coal rights:—
Smutsog No. 143, Ermelo District, in extent 9,801,511 acres.
Bankfontein No. 14, " " " " 385,203 " "
Klipfontein No. 144, " " " " 3,246,711 " "
Vaalbank (portion) No. 228, Carolina District, " 6,260,107 " "

Prospecting work is now being actively carried on with a view to determining the value of the coal deposits.

The amount standing to the debit of royalty account has been reduced by the transfer of £750 to the debit of Brakpan township, representing the value of the surface rights of that portion of the farm Weltevreden on which the township is situated.

The number of the Company's stands sold since the formation of the township is 190, of which 150 were business and 40 residential stands. The total sum accruing in respect of these stands amounts to £35,841. 10s., but owing to many of the sales having been made on the instalment system, only £15,545. 8s. 4d. has so far been received. The amount standing to the debit of the township account in the balance sheet is arrived at after debiting the account with all preliminary expenses, as well as the value placed upon that portion of the land upon which the townships situated, less the amount received from sales.

GOLD MINING INTERESTS.—The tenth annual report of Brakpan Mines, Limited, is published concurrently. The Company's holding in Brakpan Mines, Limited, remains unaltered at 253,500 fully paid £1 shares.

SPRINGS MINES, LIMITED.—The fourth annual report of the Springs Mines, Limited, is also published. The Company continues to hold 250,000 fully paid £1 shares in Springs Mines, Limited.

COAL WINNING.—The profit derived from the sale of coal amounted to £28,863. 4s. 4d. less a sum of £483. 18s. 6d. in respect of Government Probita Tax, or a shortfall of £11,043 as compared with 1911. This is in the main due to the decrease in the profit from De Rietfontein Colliery.

The output from the collieries, which amounted to 465,142 tons, was dealt with through the Transvaal Coal Owners' Association (1910) Limited.

During the year the agreement under which the Coal Owners' Association was formed, and which expires on June 30 next, was renewed for a period of five years to June 30, 1918.

ACCOUNTS AND FINANCE.—The amount of capital expenditure at the De Rietfontein colliery during the year was £250,188. 11d., unavoidable extensions to mine buildings being responsible for the outlay. The sum expended under the same head at Oogies colliery was £11,865. 18s. 6d., the chief items being a new Kielder compressor, a 250 N.H.P. Stirling boiler, coal cutting machinery, and extensions to the screening plant and air pipe line.

The finances of the Company have been considerably strengthened by the dividends accruing on its shareholdings in Brakpan Mines, Limited.

The directors recommend that the following interim dividends, which they have already paid, be declared the dividend for the year 1912:—

No. 25 7½ (8s. 6d. per share) £40,932.
No. 26 12½ (28s. 6d. per share) £48,220.

CONSULTING ENGINEER.—During the year, Mr. W. L. Honhold who for many years acted as consulting engineer to the Company resigned, and has been succeeded by Mr. C. E. Knecht.

CONSULTING ENGINEER'S REPORT.

Factors influencing the coal trade during the year made it increasingly difficult for coal prices in the Springs district, working the poorer grades of coal, to maintain the rate of production which they enjoyed in former years. In consequence, De Rietfontein colliery shows a decreased output of about 50,000 tons, most of which was expended during the latter half of the year. These circumstances, taken in conjunction with the indifferent nature of the year's development, point to the suspension of operations at a somewhat earlier date than previously anticipated and the transference of the tonnage allotment to Oogies.

Oogies colliery shows an increased production of about 10,000 tons as compared with that of the previous year. Although the bulk of the output continues to be won from the lower seam, development carried out on the upper seam has disclosed a work-

able section which will add materially to the capacity of the pit. Certain additions to plant are now under way in anticipation of the De Rietfontein allotment being taken over. It is hardly necessary to point out that coal profits will be favourably affected when the total output of the Company is dealt with at Oogies.

Boring operations of a prospecting nature were undertaken towards the close of the year on certain farms in the Breyten district. The work has not yet progressed sufficiently to allow of an opinion as to the merits of the ground.

C. E. KNECHT,
Consulting Engineer

OOGIES COLLIERY.

I beg to submit my report covering operations at this colliery during the year ended December 31, 1912. The output of all classes of merchantable coal sold, and the percentage of each class, was as follows:—

	Tons.	Percentage.
Round Coal	258,468½	79.6
Nut Coal	22,240½	6.8
Pea Coal	7,966	2.5
Fines	35,927	11.1
Total	324,602	100.0

This shows an increase as compared with the previous year of 10,169 tons.

The aggregate development of the main or lower seam totalled 12,695 feet. With the exception of a few local irregularities a satisfactory section of coal was exposed at all points. The new air shaft sunk during the year was completed, and 1660 feet of development was accomplished on the upper seam, exposing a fair average coal. At present the coal won from this seam is lowered to the bottom seam levels and hauled to the main hoisting shaft, but provision has been made to hoist directly to the surface through the air shaft if later on found expedient. The completion of the new air shaft has considerably improved the ventilation of the mine.

All machinery and plant has been maintained in a good state of efficiency. The principal additions were a 40-drill Riedler compressor, a 250 N.H.P. Stirling boiler, about 3000 feet of 8-inch air mains, and 15 coal cutting machines. All buildings have been kept in a good state of repair. Additions consist principally of new engine room for compressor, extension to boiler house, and new quarters for medical officer.

The supply of labour and the general health of the natives has been on the whole satisfactory.

E. WILLIAMS,
Manager.

DE RIETFONTEIN COLLIERY.

I beg to submit the following report on the work done at this Colliery for the year ended December 31, 1912.

The output for the period under review was as follows:

	Tons	Percentage
Round coal	92,434	65.17
Nut coal	34,046	24.00
Pea coal	15,360	10.83
Total	141,840	100.00

The total sales since the commencement of work at this mine now amount to 1,951,214 tons.

During the past year the working faces have been extended chiefly to the south. Coal of average quality has been found in this portion of the mine, but, owing to the ground being very tilted and faulted, development has been slow and expensive. Development west of the new shaft has been gradually curtailed during the year owing to the poor quality of the coal. No additions were made to the plant during the year, but a considerable amount of repair work was necessary, especially to the timber portion of the plant. The pumping plant has been maintained in good working order, and all other machinery and plant are in good repair. No new buildings have been added, but certain necessary alterations to the Manager's house and the Compound roof have been made.

The health of the native employees during the past year has been exceptionally good.

L. D. NORMAND,
Manager.

THE MYSORE GOLD MINING CO., LTD.

THE thirty-third ordinary general meeting of the shareholders of the Mysore Gold Mining Company, Ltd., was held on March 19 at the Cannon Street Hotel, E.C., Capt. W. Bell McTaggart, chairman of the company, presiding.

The Secretary (Mr. W. F. Garland) having read the notice convening the meeting and the report of the auditors,

The Chairman said that during the year 299,660 tons of quartz were milled, yielding by amalgamation 200,662 oz. of bar gold; an average of 13 dwt. 9 gr. per ton of ore. From 247,340 tons of tailing and 7476 tons of slime treated a further 31,025 oz. were recovered, making, with 75 oz. obtained from cyanide slags, a total production of 231,762 oz. of bar gold, the equivalent of 232,737 oz. of standard gold. This realized £904,079, or, after deducting royalties of £51,277, a net amount of £852,802. The expenditure on revenue account was £347,033, and the profit for the year £513,845. The amount of working expenses was only 40%, and 60% remained as profit, that is, after paying everything out of revenue, including capital expenditure and other things. The amount of the royalties was £51,000 and the amount of income-tax £27,000, a total of £78,000. Now, royalties and income-tax were not, strictly speaking, to be allocated to the mine costs and if these were deducted the working costs would be only 33%. At December 31, 1911, the profit and loss account showed a credit balance of £168,267. From that had been deducted the balance dividend of 4s. 6d. per share and bonus of 6d. per share paid on March 12, 1912, and the remuneration to the directors and managers on the dividends for 1911, leaving £10,267. Adding the profit for 1912 a total was arrived at of £525,599. The items chargeable against that amount in the profit and loss account aggregated £320,322, leaving available for distribution, as at December 31 last, £205,277. On the 14th instant a final dividend for the year of 4s. 6d. per share, together with a bonus of 1s. per share, was declared, free of income tax, representing £167,750, and the balance of £37,527. 2s. 6d. had been carried forward to the current year's account.

The quartz milled during 1912 was 8183 tons in excess of that crushed in the previous year. The realized value of the output—£904,079—compared with £896,651 for the preceding year, an increase of £7427. The improvement in the total gold obtained was due to the treatment of slime by the experimental plant referred to in the superintendent's report of twelve months ago. The result of this experiment had been such as to justify the installation of a large permanent plant for dealing with the slime.

It was gratifying to observe that the reserves of ore in the mine again showed an increase of 37,629 tons, bringing the total estimated quantity up to 1,337,998 tons. A further asset of considerable value was the large accumulation of tailing and slime at surface awaiting treatment.

They had from time to time alluded to the benefits accruing to the company by and since the completion and equipment of Edgar's shaft to a vertical depth of some 2600 ft. The continued deepening of the mine had now rendered it necessary to resume the sinking of that shaft to a vertical depth of 4000 ft.; this work had been commenced and would be carried on with the

utmost expedition possible. The new vertical shaft at McTaggart's section, to which reference was made in the last annual report, was also being proceeded with, and would be taken down to the required depth to strike the reef, which should approximate to 2400 ft. These important and necessary additions to the large amount of development and exploratory work regularly in progress and the ultimate equipment of the shafts, taken in conjunction with the proposed installation at surface of a new slime plant and tube-mills, as well as other improvements and additions called for in the general arrangements of the machinery and plant, would naturally involve a considerable outlay during the next three or four years.

Mr. John Taylor seconded the motion for the adoption of the report and accounts.

Mr. Edgar Taylor said that the reserves in McTaggart's section amounted to some 157,000 tons, and the substantial discoveries made during recent years amply warranted a more extended scale of development. They had got good news lately that the 3100-ft. level north, which was driven some 400 ft., had improved to 2ft. in width and 1 oz. 17 dwt. in value, showing that the shoot here was extending in depth. In the more central workings at Ribblesdale's shaft, which shaft was worked in conjunction with the auxiliary and Rowse's inclines, they had an enormous extent of ground developed and standing intact. No stoping had yet been done at any of the fifteen deeper levels. The deepest two levels, Nos. 14 and 15, which were started during the past year, had not yet attained anything like the same lateral extent as those higher up, but the averages of 17 and 14 dwt. for the distances of 322 and 115 ft. at present driven and mentioned in the report compared not unfavourably with results higher up. Speaking generally, there had been no discoveries of exceptionally rich runs of ore in this section during the year. The superintendent classified the ore ground opened up here as of "medium grade." With regard to Tennant's section, here they had continued to make excellent developments. At No. 1 level especially they had had gratifying results. During the whole of last year this drive was advanced in a fine reef, and values had continued into the present year. The latest advice (February 19) gave a value of 1 oz. 13 dwt. over a width of 3 ft., and they had still 250 ft. to go before reaching the boundary. The level above, numbered on the old system 2890 ft., had lately been started on a new part of the lode, and in February was worth 2½ oz. over a width of 2 ft.

They had reported from time to time that the application of electrical power to the machinery had been most successful. They had already in use motors, driving mills, compressors, winding-engines, pumps, cyanide works, workshops, sorting-floors, and other plant, and they had found that, as compared with steam power, steadier running had been obtained and economy shown. For some time past they had been in communication with the Mysore Government, who had supplied power from the Cauvery Falls, and during the recent visit of Mr. Henry Taylor to India, an agreement for the supply to the mines of an additional amount of power was come to. They were already using nearly 3000 horse power.

The report was adopted unanimously.

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Scientia non habet inimicum nisi ignorantem.

T. A. RICKARD, Editor.

EDGAR RICKARD, Managing Director.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2,240 lb

	Feb 28 Tons	Mar 31 Tons	April 30 Tons
In England	1,917	2,187	21,764
In France	4,084	4,204	6,523
At sea from Chile	2,3	2,000	2,050
At sea from Australia	8,800	4,000	3,400
In Rotterdam	4,100	5,500	6,200
In Hamburg	4,427	4,863	4,900
In Bremen		2,400	2,271
In other European Ports		2,500	2,000
Total European visible supply	44,075	47,574	45,898

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES
In Tons of 2,240 lb

	Deliveries			Stocks at end of month
	Produce	Domestic	Foreign	
Total, 1911	639,258	316,791	337,000	653,900
Total, 1912	709,022	368,920	333,212	693,132
January	61,053	29,411	26,956	56,087
February	58,460	26,641	26,219	58,840
March	60,827	31,160	31,082	68,872
April	60,416	34,842	38,346	73,288

PRODUCTION OF GOLD IN THE TRANSVAAL

Year 1912	Rand			Else where		Total	Value
	Oz	£	Oz	£			
1911	8,753,563	370,751	9,124,490	38,757,500			
January 1913	790,981	28,400	789,390	3,553,116			
February	702,394	31,728	734,342	3,118,352			
March	761,214	2,228	760,582	3,358,050			

COST AND PROFIT ON THE RAND

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit	
1911	23,888,260	8 d	8 s. d.	8 s. d.	11,414,863	
January 1912	2,067,161	27	6	18	10	977,557
February	1,983,96	28	4	19	2	907,192
March	2,163,928	28	1	18	11	1,204,764
April	2,036,592	28	6	19	0	1,005,920
May	2,177,338	28	6	18	9	1,073,534
June	2,110,657	28	5	18	6	1,063,634
July	2,144,785	28	6	18	8	1,061,089
August	2,121,455	28	9	18	10	1,055,315
September	2,081,295	28	7	18	8	1,040,820
October	2,097,791	28	0	18	3	1,074,334
November	2,157,600	28	2	18	5	1,059,264
December	2,215,405	28	0	18	10	1,144,372
January 1913	2,215,405	27	8	18	0	1,113,579
February	2,190,157	27	11	18	3	1,019,774
March	2,141,154	27	8	17	8	1,121,756

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
April 30, 1912	197,137	8,764	13,785	220,086
May 31	193,829	8,460	14,538	216,827
June 30	188,494	8,549	15,530	212,573
July 30	182,265	8,497	15,834	207,256
August 31	174,111	8,266	15,934	203,811
September 30	190,709	8,283	15,752	205,274
October 31	182,488	8,803	15,496	206,357
November 30	196,881	8,767	14,872	210,520
December 31	191,226	8,964	14,965	214,945
January 31, 1913	200,009	8,774	13,912	222,791
February 28	207,662	8,777	13,948	230,457
March 31	207,733	9,000	15,041	231,774

GOLD OUTPUT OF INDIA.

Year 1911	Year 1912	April 1913	Year 1913
£2,150,050	£2,265,094	£191,215	£748,821

PRODUCTION OF GOLD IN RHODESIA

MONTH.	1909		1910		1912		1913	
	£	£	£	£	£	£	£	£
January	301,666	227,511	214,918	2,077,776				
February	192,497	303,888	209,744	208,741				
March	202,157	228,385	215,102	257,297				
April	222,700	228,213	221,476					
May	225,032	233,888	231,407					
June	217,600	214,709	226,867					
July	225,234	195,233	200,514					
August	228,296	191,423	239,077					
September	213,249	178,980	230,573					
October	222,653	234,928	230,072					
November	236,307	240,573	225,977					
December	233,397	199,500	218,661					
Totals	2,623,788	2,568,201	2,707,308					

PRODUCTION OF GOLD IN WEST AFRICA

MONTH.	1911		1912		1913	
	Oz	Value	Oz	Value	Oz.	Value
January	15,903	66,107	26,098	107,262	31,857	144,262
February	15,179	63,081	25,009	102,270	32,544	137,038
March	16,387	67,675	27,228	111,326	36,289	150,000
April	17,237	70,880	27,790	114,796		
May	24,437	96,409	28,015	115,678		
June	22,555	92,174	27,781	113,697		
July	22,510	91,955	30,974	127,806		
August	25,385	103,753	33,015	136,407		
September	26,717	109,039	34,401	142,397		
October	26,826	109,503	34,436	142,414		
November	24,280	99,209	33,183	137,700		
December	24,590	99,569	34,917	144,382		
Totals	261,784	1,060,442	362,940	1,497,179		

PRODUCTION OF GOLD IN WESTERN AUSTRALIA

	Export oz	Mint oz.	Total oz.	Total value £
Total, 1910	363,496	1,209,856	1,573,352	6,682,042
Total, 1911	160,021	1,240,447	1,370,468	5,823,522
Total, 1912	83,589	1,199,060	1,282,649	5,449,057
January 1913	9,738	94,067	104,705	444,756
February	8,780	92,207	100,987	428,963
March	754	97,015	97,769	415,294
April	7,920	103,324	111,244	472,532

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	April 1913	1913 to date
Victoria	2,138,000	2,039,400	168,000*	435,600*
Queensland	1,623,390	1,384,169	89,000*	276,750*
New South Wales	769,353	702,149	41,036	201,958
New Zealand	1,808,049	1,345,115	74,000	335,982

* March figures only.

SALE OF TIN CONCENTRATE AT RIDDUTH TICKETINGS.

	Tons	Value	Average
Year 1911	615½	£702,599	£114 4 5
Year 1912	649½	£831,908	£128 5 6
January 6, 1913	231	£32,769	£141 17 2
January 20	257½	£36,647	£142 9 1
February 3	260½	£36,221	£138 18 3
February 17	236	£32,393	£137 5 2
March 3	252½	£33,251	£131 13 9
March 17	229	£29,302	£127 19 2
March 31	258	£31,256	£132 15 6
April 14	217½	£30,512	£140 2 6
April 28	262	£36,327	£138 13 1

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA
Reported by A. STRAUSS & CO.

	1912 tons	Apr 1913 tons	1913 tons
Metal from Straits to Europe and America	59,036	4,419	19,867
Metallic Content from Bolivia to Europe	21,149	2,760	7,816

REVIEW OF MINING

INTRODUCTORY.—The stock exchanges of Europe continue to be dominated by political developments in the Near East. These have verged on the farcical, but the result has been invariably serious, creating renewed spasms of distrust. The histrionic affair at Scutari and the assumption of kingship by an adventurous pasha have reduced the political situation to *opera bouffe*, but behind the petty performances of a handful of Montenegrins has loomed the jealousy of Austria and Russia. Until final arrangements are made for the distribution of territory conquered by the Balkan allies, the spectre of war will chill the air of the European bourses. And until this Balkan affair is thus finally settled, no sane financier will engage in speculative commitments. This means that the mining department, like the others, will languish. Apart from its intimidating effect, the Balkan troubles have affected the consumption of base metals, especially copper and tin.

TRANSVAAL.—The Union Government has decided to prohibit the importation of natives from tropical Africa, owing to the mortality among them when working in the mines of the Rand. This step does not come as a surprise, and the houses will recognize that the policy is right, from the points of view both of humanity and of economic law. We may expect also, in the near future, some strong Government action with regard to the white miner and the ravages of phthisis.

Rumours concerning the Brakpan have been used by bear speculators. Subsidence of the hanging wall in places has interfered with the extraction of ore. Official information is that no real cause for anxiety exists. Troubles arising from faulty ground, water, and subsidence happen to coincide, but the management assures shareholders that the mine is being

worked fairly and in accord with the systematic plans previously formulated. Of course, in the Brakpan the lode is particularly flat, rendering pressure unusually heavy on the hanging wall, but those in charge know enough to leave sufficient pillars for safety. The management is both capable and honourable, so that we take their assurance as satisfactory.

The rumour that the Robinson mine is to be swallowed by the Crown Mines is contradicted, but we believe that it is a correct, if premature, anticipation of events.

Our Johannesburg correspondent refers to the anxiety felt with regard to the developments at the Cinderella, and voices the opinion that milling may have to be suspended until such time as a full supply of profitable ore is available, and the working cost per ton milled thereby restored to a more reasonable level.

By cable the news comes that the Hercules shaft of the East Rand Proprietary has cut the 'reefs,' and that the ore disclosed is of poor quality and the beds thin. The Hercules section is the most easterly of the deep levels of the East Rand Proprietary, and is the immediate neighbour on the west of the Cinderella. The shaft cut the beds at 4236 ft. vertical; the Main Reef Leader was proved to be 13 in. wide and to assay 3'2 dwt. per ton, and the Main Reef 19 in., and assay 1'8 dwt.

The output for April of the East Rand Proprietary Mines was worth £245,977, or £6960 less than during March. The yield per ton was 30s. 4d., as compared with 31s. 1d. in March, but on the other hand the working cost was reduced by 10d., from 19s. 5d. to 18s. 7d., so that the profit per ton remained much the same. The working cost has been reduced every month since the commencement of the year, and the April figure is 2s. 3d. lower than the average for 1912.

RHODESIA. The March output of gold was 61,774 ounces, worth £257,797. This is a considerable gain, and constitutes a record. It is due largely to the Globe & Phoenix, whose production was increased from £33,232 in February to £43,681 in March. Among other mines to score an increase are the Giant, Lonely Reef, and Selukwe-Columbia. The number of contributors during the month decreased, however, from 180 to 175.

The Shamva is doing better. On the 4th level the ore has been proved, by two cross-cuts, to be wider than on the 3rd level. This is a curious orebody: apparently it is a sheer-zone in quartzite, not conglomerate or even agglomerate, as has been claimed. Official statements regarding the mine have afforded but little real information. A geological diagnosis, accompanied by proper maps and sections, ought to have been forthcoming long ago, together with estimates of the *total* cost of winning the gold from this low-grade deposit. Shamva has served as a gambling counter, like most of the Rhodesian mines, instead of being the basis of genuine industry. The railway to the mine was opened in mid-April.

The Eldorado is in trouble owing to a caving of ground having interfered with hoisting. This has prevented the completion of trial crushings on the so-called Parallel Reef. So far the results indicate that the supposed ore cannot be exploited profitably. A reduction in the grade of ore to be treated is forecasted. The information given is incomplete and unsatisfactory.

The Lonely Reef mine has difficulty with the lining for the tube-mills. The attempts to utilize the harder parts of the ore and country-rock have proved unavailing. Experiments are being made with various types of iron linings.

WEST AFRICA.—The March output of gold is stated officially to have been 36,289 ounces, worth £150,060. This is not only an increase on the previous month, but is the highest on record. The Abbontakoon made an advance,

both in tonnage and yield, from 8070 tons yielding 4028 oz. in February to 9420 tons yielding 6164 oz. in March, but the product credited to March includes 1924 oz. from the clean-up of the tube-mill. The Abosso also did well, as did both the dredging companies. The Ashanti output fell slightly below its normal, because the non-delivery of wood-fuel stopped the re-treatment of old tailing.

NIGERIA.—Divisible profits are being earned by an increasing number of Nigerian tin producers. The Kaduna Syndicate made a profit of £4001 from 86 tons of concentrate, and divided £3000 among shareholders. As the nominal capital is only £10,000, this proportion of profit is satisfactory. We note that the 5-shilling shares stand at over £1. The Bisichi made a profit of £10,007 from 281 tons, and distributed £10,000, being at the rate of 5% on a capital of £200,000. The South Bukuru announces a first interim dividend of 5% on a capital of £44,807.

We referred last month to the cable messages sent by Mr. J. F. Balfour in connection with the Kopp Tin Company's properties. This company is in the control of Mr. Edmund Davis, and the speculation in the shares has been boisterous. The directors have now circulated Mr. Balfour's written report, dated March 31. From this it appears that the chief reason for the advance in share quotations was the fact that in one spot the calabashers were able to pick the cassiterite by hand. The property belonging to this company is situated about 40 miles south of Naraguta.

AUSTRALASIA. We refer elsewhere to the transfer of the control of the Mount Morgan. Later messages from Australia show that recent developments have proved an ore reserve of 7½ million tons, sufficient to last for twelve to fifteen years. The present rate of output will be maintained at about 820 tons of blister copper per month, containing 12 to 14 ounces of gold per ton. By March next year, it is expected that the new smelting plant will be

ready for use. With this plant the monthly production will be 1000 to 1100 tons of blister copper and 12,500 ounces gold.

The sudden collapse of the strike at Broken Hill was most fortunate. While it lasted, the lead market was stiffened. The quarrel arose on the insistence of the Union that the confidential employees of the Silverton Tramway Company should take a card of membership, while the company insisted that these members of the staff should remain free. In consequence of this disagreement not less than 7000 men were compelled to stop work, and a big industry was jeopardized. Our Melbourne correspondent gives an outline of the labour situation at Broken Hill.

The Broken Hill South Silver is to erect a plant for the treatment of slime by means of selective flotation. Experimental work has been conducted at this mine and at the South Blocks for the last year or two with a view of arranging the flotation agents in such a way as to raise the galena first and the blende afterward. The flotation of the galena can be effected without acid, and at the present time this is being done at the South Blocks. The invention of the selective method as used at the South Blocks is due to Mr. James Lyster, the mill foreman for the Zinc Corporation. Blende requires acid, and if much calcite is present the action is vitiated. The amount of calcite varies at the different mines: at the Proprietary it is found in just sufficient quantity to suit the Potter-Delprat process. Further improvements are being made at the South Silver company's lead-concentrator. The company is also about to sink a new shaft for the purpose of developing the southern portion of the mine.

Important developments are now taking place at the South Blocks mine, belonging to the Zinc Corporation. This mine contains two lodes, one preponderating in lead, and the other in zinc. The cross-cut at the 8th level on the former is giving excellent results, for whereas on the upper levels the lode averages

14 to 18 feet in width, on the lowest level it is 50 ft. thick as far as at present explored. The ore disclosed in this cross-cut is of higher quality than in the upper narrower parts. The geological inference is that the wide lode characteristic of the central part of the Broken Hill district has been found.

The Zinc Corporation has acquired a two-thirds interest in the Sunny Corner silver-lead-zinc mine, in the Bathurst district of New South Wales. Some years ago the oxidized surface ores were worked for silver, but the complexity of the sulphide ores was too much for the owners. A separate company is to be formed to work the mine. Much development work has to be done before the actual value of the sulphide orebodies can be ascertained.

The cabled summary of the report of Block 10 for the six months ended March 31 is depressing, for the profit has dropped from £36,049 to £16,860. For some time the developments have disclosed a fall in the quality of the ore at depth, and moreover re-sampling of reserves indicated a lower content than originally calculated.

Great Cobar has declined still further, so that the quotation stands at about half what it was just before Mr. C. S. Herzig's report was published. It is said that there is a creep above the No. 8 level, that the Chesney concentrating mill is doing badly, that the staff is at loggerheads with Mr. F. Danvers Power, who is manager during the absence of Mr. H. C. Bellinger. It is a fact that sundry items of bad news have reached the market a day or two before the directors received official information: hence it appears that disloyal employees are adding to the troubles of this most unfortunate enterprise. On the top of it all there is a feeling of uncertainty as regards the persistence of the main orebody. Mr. Bellinger will have his hands full when he reaches the mine. The labour troubles do not arise solely from the company's employees, but also from the strikers at the Newcastle collieries.

The smelting plant has thereby run short of coke and will have to be closed for quite a month.

Developments at the Victorious mine, belonging to the Associated Northern Blocks, continue to reveal high-grade ore. In winze No. 2 below the fourth level the ore throughout the 20 feet so far sunk averaged 110 shillings over 60 inches; and the first 10 feet sunk on winze No. 3 averaged 200 shillings over 48 inches. Further sinking will be keenly followed.

It is reported that Lionel Robinson, Clark & Co. have taken an option on the Slippery Gimlet mine at Ora Banda. This district has gained prominence lately by the successful development of the Victorious mine belonging to the Associated Northern Blocks.

From the Bullfinch comes the good news that the northern orebody has been cut on the 310-ft. level, yielding good assays. Work is hindered by lack of labour.

Illness kept Mr. F. A. Govett from presiding at the Ivanhoe meeting; but those present were brought in contact with the chairman's vigorous personality by the reading of an address prepared by him. Last year we made humorous reference to a characteristic gasconade in which he claimed a good deal of credit for himself, so we are glad to see how this year he goes out of his way to make generous acknowledgments to the manager, Mr. R. B. Nicolson. The Ivanhoe shareholders are well treated in the way of information and have ample reason to appreciate the fact that they are getting a good run for their money.

Those who followed the history during 1912 of the Mount Boppy gold mine, in New South Wales, not far from Cobar, would not be surprised to hear that a loss had been made for the year, thus breaking the continuity of dividends for over ten years. The exceptional drought caused a stoppage of operations for two months. It just happens that at the present time money was being provided out of

profits to pay for a new metallurgical plant to treat the pyritic ore, so that the financial squeeze due to cessation of milling came at an inopportune moment. The directors, and the managers, John Taylor & Sons, considered it best to issue 30,000 preference shares, bringing the capital to £151,000, in order to pay for the plant and to provide a balance of working capital.

At the Whim Well copper mine in West Australia, trouble has been experienced with the crushing plant feeding the Murex magnetic separator. The presence of kaolin interferes with dewatering and wet screening, so a change has been made from wet to dry crushing, with satisfactory results. It will be remembered that calcite rendered acid-flotation processes impossible. The developments at depth are highly satisfactory, and large bodies of high-grade ore have been exposed. To meet the expenditure on additional plant £25,000 has been subscribed, bringing the total issued capital to £300,000.

The dissenting English shareholders have succeeded in securing recognition with regard to the reconstruction of the Chillagoe company. A writ restraining the transfer of the assets to the new company was threatened, with the result that the company has undertaken not to complete the transfer at present. The cable states that the contract of sale gives a lien over the assets for any compensation due to dissentient shareholders.

The Lloyd Copper Company has re-started the operation of the Burruga mine in the Bathurst district of New South Wales. The property was floated in London in 1899, and smelting was done from 1905 to 1908. The furnaces depend on wood fuel, and as supplies in the immediate vicinity were exhausted in the latter year, the works had to be closed. Last year £20,000 was raised for the purpose of building a railway that will tap forests farther afield, and smelting was resumed in February. The mine has a large reserve of ore

averaging 4 to 5 per cent. A flotation plant is being built, and by its means the concentration will be greatly improved.

The geological report on the Waihi district is now made public. We gave the gist of it in November 1911. Moreover, the salient features of the investigation were known at Waihi in March 1911. If the report had been published then, it would have been deeply interesting. The delay is unfair to the Geological Survey of New Zealand, and highly discreditable to the Government of that Dominion.

As regards the Waihi company, the latest news by cable is that at the 10th level on the Royal lode 24 ft. averages 37s. per ton, the first ore worth treating so far found on this level. The developments on the Empire lode are in broken ground, but 15 ft. was in ore averaging 57s. 6d. per ton.

The Briseis company, owning tin-gravel mines in Tasmania, has obtained a 6-months option on the Mitta lode-tin property in the northeast of Victoria. This company already has gold-gravel interests in that State.

CANADA.—The recent developments at the Casey Cobalt have exposed so much ore that the directors have decided to increase the capacity of the concentrator from 25 tons per day to 75 tons, instead of only 50 tons as contemplated, and to install electric power. The funds for this extension are to come from current earnings, so the payment of dividends will be postponed for a short time. Mr. J. Mackintosh Bell, acting for L. Ehrlich & Co., has acquired a working option on the Keeley mine at South Lorrain.

UNITED STATES.—Our New York correspondent sends information relating to the success of the Minerals Separation process at the Inspiration copper mine, Arizona. A block of shares in the Inspiration Company has been introduced on the London market.

The Ducktown and the Arizona are practically the only English companies working

copper mines in the United States. Though both have been in existence for many years their prospects have never been so bright as now. The Ducktown company is able to announce discoveries of large bodies of ore in the bottom level of the Mary mine, and the diamond-drill hole downward is still in ore which carries a higher copper content than the average. The ore is almost solid pyrite and is valuable for its sulphur content as well as for its copper.

Stratton's Independence, thanks to Mr. Philip Argall, continues to make steady returns. Out of \$2'80 dump ore, a profit of \$1 is being squeezed; and even \$3 ore is being mined and milled profitably. A new shallow adit has been extended from the floor of the old ore house to the Portland boundary, with cross-cuts under old surface workings, opening up at least 150,000 tons of remnants that can be extracted profitably.

MEXICO.—The new financial agent, Señor Louis De la Barra, a brother of the former provisional President, has created a good impression in London. He has shown evidence of a genuine desire to help those operating in Mexico.

The shares of English and French companies operating in Mexico were adversely affected by the announcement that an export tax of 10% would be levied by the Mexican government. The purpose is to support the gold currency. However, the step is not as inimical to the foreign mining companies as it seemed. A commission is to be empowered to purchase gold at par and to allow such gold to leave the country free of tax if considered advisable. This resembles the procedure in India, where the Council maintains Indian exchange by selling drafts or drawing on London as required.

A paragraph in our last issue concerning the La Fé mine has been, we understand, misconstrued, as regards the principal metal in the ore. This is silver, the lead and gold being

relatively unimportant. The average assay-value is 40s. to 50s. per ton, and this yield is fully maintained in the deepest workings.

The Esperanza Company has issued a report showing that the ore in the older part of the mine is practically exhausted, and that the San Carlos vein, though continuing to be of a promising nature as regards extent and tonnage, does not contain at the present points of development ore of as high a grade as was disclosed in the earlier workings. The consulting engineer, Mr. H. A. Titcomb, reports that the ore reserve consists of 100,000 tons, developed, partly developed, and probable, in addition to 51,000 tons of old stope-fillings.

RUSSIA.—The terms of amalgamation of the Spassky and Atbasar copper companies provide for the issue of one new Spassky share in exchange for two Atbasar shares held by other shareholders than the Spassky Company. Of the 500,000 shares in the Atbasar, the Spassky acquired 200,000 two years ago. The Spassky company has a capital of 600,000, and the new shares will bring the figure to 750,000. The holders of these 750,000 shares will be entitled to subscribe at par for 250,000 new shares, the funds thus raised being available for the developments at Atbasar, including the building of the railway and the erection of smelting plant. The issued capital of the expanded Spassky company will then stand at £1,000,000. The output of copper at Spassky during 1912 was 3998 tons, and the dividend was at the rate of 25 per cent.

The Russo-Asiatic Corporation has acquired valuable options in Russia. These include a concession covering silver-lead-zinc deposits in Eastern Siberia; lead-gold deposits in the Altai; two copper properties in the Semipalatinsk district, and an estate adjoining the Kyshtim. Messrs. D. P. Mitchell and A. F. Kuehn are now engaged in examining these various properties.

INDIA.—Exploration of the ground to the south of the Mysore mine is being conducted

conjointly by the Mysore, Kempinkote, and Goldfields of Mysore companies. Hitherto the continuation of the lodes south of the Mysore has given poor results by development from surface. The work now being done is intended to test the deposits at greater depth, and driving has been started from the 2385-ft. level in MacTaggart's section of the Mysore. The cable messages so far received are brief, mention merely being made of the lode being 18 inches wide and assaying 16 dwt. at one place, and 3 feet wide and assaying 1 ounce at another.

The Ooregum, which last year passed through one of the recurrent times of anxiety characteristic of the mines on the Kolar gold-field, is now developing in a much more encouraging manner, and Mr. Edgar Taylor, at the shareholders' meeting, gave a more hopeful report than he had expected to be able to do six months before. At all the development points at depth profitable ore is being exposed, and a new shoot has been discovered at the bottom of Oakley's shaft, after the workings in this section had gone down 1000 feet through unprofitable ground.

SPAIN.—The Tharsis Sulphur & Copper Company has obtained a new lease of life in consequence of recent developments at depth at the Calanas mine. This company has already had a highly prosperous existence for over 45 years, and the ore reserve will provide supplies for another 20 years. It is notable that the ore in depth is higher in both sulphur and copper than that which was mined by open-cut. The total dividends to date have amounted to close on £10,000,000, and £2,500,000 has been paid out of profits for properties and equipments. The mines stand in the balance-sheet at the nominal figure of £20,000, and the company has a reserve fund of over £1,000,000. The technical control is with the Tennants, the Glasgow firm of alkali manufacturers, who are also known as the great financial supporters of the Indian gold mines.

EDITORIAL

AMONG the gifts mentioned in connection with the fashionable wedding of the season, uniting the Cecil and Ormsby-Gore families, was a copy of 'Agricola.' It was a present that will remain interesting long after the necklets and cigar-cases have served their turn.

THE ANNUAL DINNER of the former students of the Royal School of Mines will be held on June 9. The committee recently elected Mr. T. A. Rickard as honorary secretary, and tickets (12s. 6d.) can be obtained from him at 819 Salisbury House. It is hoped that the attendance will be large and representative.

SOME SENSATION has been caused in Bengal by the report of Mr. P. E. Billingham, M.I.M.E., on the mineral wealth of an encumbered estate called Dhalbhum, in Chota Nagpur. This gentleman came to the conclusion that Dhalbhum was "the site of what was potentially one of the world's greatest goldfields." His evidence is not convincing. We told a true story of gold mining in Chota Nagpur in our issue of December last.

CONCRETE and ferro-concrete have been energetically brought to the notice of mining engineers, and in many ways these materials of construction can be applied usefully in mines. But they have a disadvantage, due to the length of the period required for the concrete to gain its maximum strength. The delay thus involved will often cause inconvenience and even loss, if the concrete is made and built-up in place. Thus, in lining a shaft or supporting a roof or wall, timbers or steel sets can be placed in position and work started in a fraction of the time required

for the concrete lining or support to set properly. A good example of our point is provided by the re-building of Baker Street station on the Metropolitan railway. Here the traffic and the platform circulation have been seriously impeded for months owing to the pillars of reinforced concrete having to be left to harden. Mining engineers who pass through this station will do well to remember the circumstance when debating the advantages claimed for this class of structural work.

WE ARE INFORMED that the *Mining and Scientific Press* will establish an editorial office in New York, and that Mr. Thomas T. Read, associate editor, has left San Francisco to fill this appointment. Meanwhile Mr. Eugene H. Leshe will go from Mexico to San Francisco, and, with Mr. M. W. Von Bernewitz, will be an assistant to the editor, Mr. H. Foster Bain. These changes and additions should add greatly to the efficiency of our Californian contemporary.

TIN is one of the mineral assets of the Transvaal. We publish a letter from Mr. G. H. Blenkinsop on the origin of the deposits in the Bushveld area. He punctuates a fallacy. In this case, as in many others to which economic geology is applied, it would be well to study the local rock-structure more and the theories of origin less. It is the local enrichment that constitutes an orebody, and that enrichment is conditioned largely upon the structural geology.

COMMENT has frequently been made during recent years on the absence of mine plans from the reports issued by companies working on the Rand. We take pleasure, therefore, in recording that some of the

companies are now more communicative in this way. The drawings of the Knight Central, as reproduced in the section devoted to Company Reports at the end of this issue, are of interest, in that they show the numerous dikes, the relative position of the two 'reefs' that are worked, and the proposed method of developing the ground to the south of the great Summer dike. Such pictures are more illuminating than battalions of dry figures.

WE HEAR that the Institution of Mining Engineers is taking steps to obtain a royal charter of incorporation, as well as the Institution of Mining and Metallurgy. The former is a federation of six local societies in Great Britain interested in coal mining principally, and iron mining in a subsidiary way. The only society not within the pale is the South Wales Institute of Engineers, which, for reasons sufficient for itself, holds aloof. The most important of the group is the North of England Institute, with headquarters at Newcastle-on-Tyne, and it has already a royal charter of its own. At one time an attempt was made to effect some sort of consolidation of the Institution of Mining Engineers and the Institution of Mining and Metallurgy, but the objects, aims, and scopes of the two organizations have so little in common that any amalgamation or affiliation was judged to be rather a hindrance than an advantage.

SHAREHOLDERS' meetings are sad affairs, especially if things have gone wrong. When the chairman, Sir Henry W. Bliss, of the Radium Ore Mines, addressed five shareholders in annual meeting, he showed courage worthy of a better cause. This company was registered 18 months ago with a capital of £150,000, to make money out of the radium ores to be extracted from the Tolgarrick mine. Now more money is needed to find ore, and the directors, in truly contrite spirit, "will be glad to receive the advice, and

hope to obtain the active assistance, of the shareholders." The latter are apt to be more free with advice than with financial assistance. A mine without ore is a lamentable form of property. Even the swan song sung for the Radium Ore Mines by so sweet a singer as Mr. Herbert Thomas, in the *Cornish Post*, is not likely to stir the unfortunate proprietors to a new venture in search of the radio-activity said to lie hidden somewhere in a hole in the ground. The chairman referred to the conflicting reports of one of the company's engineers, according to which the veins in the neighbouring property were first stated to persist into the Tolgarrick, were then said to be cut-off by a cross-course, and were finally alleged to continue after faulting. These statements are all of equal value. Mining is indeed "essentially speculative," as Sir Henry Bliss said, but occasionally it is made somewhat unnecessarily speculative. A chairman need not be an expert, but he ought to know enough to be able to protect the shareholders for whom he acts as chief trustee. When ignorance is bliss, 'tis folly to be wise, after the event.

ONE MORE apparently interminable lawsuit has just been settled in the United States, this time in connection with patent law, as a contrast to the 'apex' suit mentioned in our last issue. This judgment showed that the honour of inventing carborundum lay with the Cowles brothers, and not with Mr. E. G. Acheson, and the order of the court involved a payment of royalty by the latter to the former up to June, 1902, the date of the expiry of the Cowles patents. It is due, however, to Mr. Acheson to say that this product of the electric furnace was introduced by him commercially, as an abrasive. The word 'carborundum' is a misnomer, as Mr. Acheson soon found after the christening ceremony. At first he thought that the crystals were produced by a combination of the alu-

mina of the clay with the carbon of the charge, and he precipitately invented what the late Lewis Carroll used to call a 'portmanteau' word. Shortly afterward, chemical analysis showed that the silicon of the clay was the active agent in the reaction, and not the alumina, and that the new product was in fact silicon carbide. But the original trade-name stuck.

THE CUSTOM adopted by some newspapers of reprinting articles or paragraphs of news that appeared years ago, for the purpose of comparing old things with new, or for reviving anniversary recollections, is apt to provide a trap for the unwary. *The Times* quotes from its issues of a hundred years ago to indicate the matters then of interest, and other English dailies have imitated with extracts from their early issues. No doubt the unsuspecting reader is occasionally given an unexpected shock, if he should fail to associate the date with the news quoted. We recollect a contemporary in America inadvertently publishing as current news several 30-year old paragraphs that had been reprinted in a Nevada paper for the purpose of informing its readers about the original discoveries and developments of one of the mining districts of that State. Another such case has been brought to our attention recently. The *Colliery Engineer*, of Scranton, Pennsylvania, in its April issue, announced "the establishment in London of the Institution of Mining and Metallurgical Engineers," and that "the headquarters at present will be at the offices of *The Mining Journal*, 99 Shoe Lane, E.C." The first impression received on reading this paragraph was that our contemporary was founding a rival to the present Institution, in whose birth it had worthily assisted twenty-one years ago. On second thoughts we came to the conclusion that the Scranton paper had incorrectly interpreted a supplement issued by *The Mining Journal* three months ago on the

occasion of the celebration of the coming-of-age of the Institution. This supplement was welcome, in that it revived old associations, and we regret, therefore, that its intention should be thus misinterpreted. We take this opportunity of allaying any anxiety or wonderment that may have been caused by the circulation of the paragraph in question.

Mount Morgan.

The large transfer of shares recently announced entails a change of control. This marks the beginning of another chapter in the story of a great mine. That story is romantic indeed, but, as is usually the case in the history of big mineral discoveries, it has its sordid episodes. Different as are the tales told concerning the manner in which the Morgan brothers acquired the property from Donald Gordon, all of them unite in telling that the sheep-herder and his prospector brother Sandy were deceived into parting with the grazing land for a mere song. Donald Gordon acquired possession of two 'selections' near Rockhampton, in 1864: one of these areas included a low hill capped with ironstone. In 1882 the Morgan brothers came thither on an expedition of investigation, and tested some of the 'float' or fragments of gossan. They found lots of gold in it. Saying nothing to Gordon of the results of their tests, they bought the land for £1 per acre. Thus for £640 they purchased title to one of the greatest treasure-vaults ever uncovered by man. Soon thereafter they sold fractional interests to Thomas S. Hall, manager of the bank at Rockhampton, to his brother Wesley Hall, a jeweller by trade, and to Messrs. D'Arcy and Pattison. They retained half, but not for long. In 1886 the original syndicate organized the enterprise into a company of a million shares, all of which were issued to the vendors, credited as 17s. 6d. paid. They became fully paid in 1902, when a special dividend of 2s. 6d. was declared against the call. Thus it may be said that

the great wealth of Mount Morgan has been won without the aid of working capital. Out of the first gold extracted by a 10 stamp battery, enough money was realized to pay for the plant and to recoup the purchase price paid to the Morgans. Some of the outcrop yielded 800 ounces of gold per ton. It was worked as an open-cut. The mine was a golden quarry. For the year ended November 30, 1889, the Mount Morgan yielded 75,000 tons of ore, averaging 4 oz. 4 dwts. per ton, giving a gross yield of £1,350,000, of which 87% or £1,100,000 was distributed in dividends. At that time the shares rose to £17½, but fell rapidly in the next two years, so that in 1892 the quotation had relapsed to 30s. This collapse, with the concurrent drop in Broken Hill Proprietary, was a factor in precipitating the Australian panic of 1893. But the extraordinary deposit in Queensland was the cap to a big body of pyritic copper ore, so that in 1906 the Mount Morgan became a producer of copper, as well as gold. The shares rose to £4¼ in 1907, dropping slowly to £2½ last year. Since then, and since the announcement of the re-organization, a recovery has ensued. This seems amply justified.

We are informed that 350,000 shares have passed from the estates of the two brothers, Thomas and Walter Hall, to a syndicate headed by Lionel Robinson, Clark & Co., with whom is associated Mr. W. K. D'Arcy, one of the original owners. The money involved in this transfer is about £1,250,000. With the change of control will come a complete re-organization, both at the mine and in the offices of the company. Messrs. Lionel Robinson and C. S. Cockburn join the London board, while Messrs. W. L. Baulieu and J. M. Niall will go on the Australian board of directors. The technical management will remain in the capable hands of Mr. Benjamin Magnus, who recently moved from the Port Kembla refinery to take charge. It is anticipated that the working cost will be diminished from 45s. to

30s. per ton. Last year we commented upon the fact that from an ore yielding 53s. per ton in copper and gold the resultant profit was only 8s. 10d. per ton. Room for improvement has long been obvious to technical observers. That improvement is now assured.

A word on the geology of the deposit. Mount Morgan was a hill 500 feet high in the Australian 'bush' or eucalyptus forest. The top of the hill has been removed by mining. More nearly than any other discovery this was the 'mountain of gold' of a prospector's dreams. Up to the end of 1912 this hill had yielded 4,000,000 oz. gold and 43,500 tons copper, and £8,029,160 had been paid in dividends. When first found it looked like a big mass of gold-bearing ironstone. When the cap of the hill had been quarried a vesicular mass of silicious ore was uncovered. There was talk of a 'geyser,' and there was pseudo-scientific drivel about "a metamorphic matrix of a somewhat argillo-arenaceous composition." It is a common trick to suppose that a large orebody must be formed differently from a small one, as if the processes of nature were measurable on the scale of a chemist's laboratory. Mount Morgan is a pyritic mass of ore deposited in sedimentary rocks where they were traversed and shattered by igneous intrusions, followed by thermal waters rich in metals. By the weathering of the upper portion of the pyritic orebody and the concentration of the gold derived from the eroded outcrop, the top of the deposit became highly impregnated with gold, its copper was leached, and its pyrite was largely replaced by silica: this left a gold-bearing ironstone cap upon a sintery mass not so rich in gold, and barren of copper; then came the pyrite, which had also been enriched with gold by descending waters; and finally the workings penetrated the primary deposit of pyrite, containing both gold and copper.

The metallurgical history is of equal interest. On the early failure of amalgamation, chlorination was adopted with success, though

the exact figures for the efficiency were never divulged. As the workings penetrated into the silicious ore carrying pyrite, roasting furnaces were added and an additional chlorinating plant provided. Finally, when the primary pyritic zone was reached, smelting was adopted in 1905. Two years ago, auriferous pyritic ore from Many Peaks was substituted for the barren ironstone flux, and unfortunately those in control of operations did not so modify the practice as was required by the presence of sulphur in the fluxing ore. The result was a temporary failure of the smelting operations and the requisition of the services of Messrs. Robert Sticht and A. L. Dean, of the Mount Lyell, who abolished chlorination and remodelled the smelting plant. Two months ago we announced the decision of the board to build an entirely new smelter, embodying the latest experience. We have every confidence that the metallurgical practice has been finally settled on an entirely satisfactory basis, and that the future will be distinguished by brilliant technical work as well as by the favours of a beneficent Nature.

Globe & Phoenix.

As the recalcitrant shareholders insisted that rich ore was being hidden in the Globe & Phoenix mine and that the prospects generally were better than officially stated, they need not be surprised if the annual report is more frank than usual and serves to puncture some of the fables circulated during the heat of the recent controversy. A heavy drain on the reserve of extra-rich ore is acknowledged, and a diminished yield of such sweetening material is anticipated because the pitch of the orebody has carried it into the disturbed ground, "in which the reef has quite died out." Other unfavourable points are recorded. On the lowest, or 19th, level the stoping-widths are much less than on the 15th, 16th, and 17th levels. "Therefore," says Mr. H. A. Piper, "it is evident that the position of the mine in

depth shows considerable improvement since the last yearly report." This *non sequitur* is quite in keeping with the cryptic statements to which the shareholders have rightly objected. We should like to see more evidence of the consulting engineer's effort to convey information that cannot be misunderstood. At the annual meeting a cablegram from Mr. Piper stated that two winzes from the 19th level were in good ore, assuring the 20th level.

The output of bullion in 1912 was worth £495,758 from 72,923 tons, while the total cost was £187,185; hence the actual cost was 51s. 4d. per ton, as against the so-called working cost of 35s. 7d. The difference is due to expenditure in London, fees and additional remuneration to directors, depreciation, and income tax, all of which are as much part of the cost of mining as tramming, pumping, or stoping of the ore. The reserve is estimated to be 170,945 tons, containing 288,897 ounces of gold, worth £1,213,367. Allowing for an extraction of 90%, the yield to be anticipated is £1,092,000. On an average total cost of 51s. per ton, the net resultant profit from the ore assured will amount to £656,000, as against a present market valuation of the mine at £1,200,000. As the persistence of the orebody is questionable, this valuation is altogether excessive. At £1½, the shares, the par value of which is five shillings, are a risky gamble, to be justified only if miracles happen.

However, the condition of the mine is scarcely regarded now, in view of the wretched squabble between various cliques, whose actions are so contradictory as to warrant scepticism as to their sincerity of purpose. At the meeting Mr. H. S. Foster suggested that the large remuneration paid to the directors for relatively unimportant administrative work was at the bottom of the scramble for election to the board. It has become apparent that the members of the board are at loggerheads, and that a united policy is improbable. Under such conditions even men of ability, and per-

sons knowing a good deal more about mining than the present directorate, are likely to be inefficient. It would be well if in selecting new directors the shareholders could be represented by persons having a first-hand knowledge of mining, allowing stock-brokers and lawyers to be in a subdued minority. Another change is obvious: a decrease in the number of directors. Why so many? If they do their work well, they deserve to be properly paid; but it is quite unnecessary to have so many of them. Usually one or two do all the work, the others acting as mere guinea-pigs. Most engineers will agree with us that what is wanted is a greater sense of responsibility, now lessened by the number among whom it is shared. Fewer directors and generous pay would tend in the case of all companies to the selection of competent men, and a gradual recognition of the fact that a director is a professional man, having special qualifications for the position of trustee.

Central Mining.

The annual report of this big holding corporation, formerly identified with Wernher, Beit & Co., is a document of decided importance, as indicating the progress of one of the largest groups of mines operated under the limitations of joint-stock finance. It is also highly interesting because the report includes an exposition of technical affairs by the corporation's consulting engineer, Mr. Hugh F. Marriott, who has won respect by his persistent effort to give real information instead of the sickly simulacrum that is doled to the shareholders of so many mining companies. The properties controlled by the Central Mining and Rand Mines companies include 15 of the principal mines of the Witwatersrand: they yielded 8,706,508 tons of ore, as against the total of 25,486,361 produced by the entire goldfield. Disregarding the intermediate statistics of yield and cost, we find that in the essential result, namely, profit per ton, this

group shows 13'31 shillings as against an average of 10'22s. for the whole Rand. The mines comprising this group accounted in 1912 for 34'2% of the total tonnage, 40'2% of the total yield, and 53'1% of the total dividends. The ore in reserve is divided into two classes: (1) 32,512,087 tons, averaging 31'3s. per ton, all of which is "blocked out and available for stoping," and (2) 3,290,168 tons, averaging 25'2s. per ton, which is labelled "ore in sight which will be rendered available for stoping by current development operations." As Mr. Marriott is a vice-president of the Institution he uses the term 'ore in sight' with the limitation officially described, but we deem it a pity he should use it in any shape. It should be taboo, for it is misleading at best. All that is stated in Mr. Marriott's lengthy description can be covered by "incompletely developed." In any case, this less certain portion of the reserve represents only 10% of the assured resources of the mines, and it must graduate into an even larger tonnage of ore only fractionally less proved. Ore 'blocked out' is positive; ore partly proved is probable. As to probability, limitless gradations are possible, and even an explanatory sentence will not define, so long as it involves futurity. Precise figures, to the last unit, are out of place in such estimates. Reference is made in the report to the effort to break a minimum of waste rock, confining the stoping as nearly as possible to the actual width of profitable ore. This is an axiom of mining, but it is one too often overlooked, and one that was recklessly disregarded on the Rand during the time when records for low cost per ton were allowed to take precedence over the basic purpose of operations, namely, a maximum profit, not per ton, but on the total output of gold. We note again, with hearty approval, the use of the term 'net resultant profit' to express "the net cash profit obtained from the tonnage milled, exclusive of any other revenue, which is available for dividend purposes and, where

required, for re-investment in improvements." The example set by Mr. Marriott in the careful use of technical terms is well worthy of the consulting engineer to so large a mining control. We note that the average rate of extraction is 95.6%, on an original gold content of 35.14s. per ton, which compares satisfactorily with the average grade of the calculated ore reserve. While the operating cost at surface has been decreased slightly, from 4.43s. to 4.18s. per ton, the total working expenditure has been increased from 19.65 to 20.15s. per ton. However, this is satisfactory, having regard to increased charges due to the compulsory adoption of an 8-hour shift, the advance in native wages, and growing expenses incurred in connection with the efforts to mitigate miner's phthisis. Among the mines of the group exhibiting a noteworthy gain in net resultant profit per ton are the City & Suburban, New Modderfontein, Nourse, and Village Main Reef; while an important decrease of profit per ton is shown by the Crown Mines, Ferreira Deep, Geldenhuis Deep, New Heriot, and Robinson. We believe we are right in associating several of the gains with the more drastic operation of so-called selective mining, that is, the elimination of all unnecessary waste, which is 'mining' in its right meaning.

The report dismisses the mention of Rhodesia with a curt remark, for this group's interest in that territory is now "very small." As regards West Africa, the Prestea's working cost, including development redemption, is given as 27.3 shillings per ton. Thus dies finally the fallacious calculation of a 20s. operating cost at this mine. Even if the figure is lessened slightly in the course of time, it will hardly justify the erroneous first estimate, for which excuse may be made, and much less the repetition of it, which was inexcusable. However, for this we do not call Mr. Marriott to account, for to him is owing the correction, not the original blunder. In-

deed we consider the Central Mining report as a good example of progressive improvement in the giving of information to shareholders, and we regard it as confirming the idea that all such progressive improvement must come on the initiative of the consulting engineers, supported by directors willing to do what is right, if convinced that it is practicable.

Electrolytic Alkali.

The collapse of the Electrolytic Alkali Company, which has worked the Hargreaves-Bird process for the electrolysis of brine for the past dozen years, at Middlewich, Cheshire, affords a lesson in connection with fuel economy and the scale of operations required for electro-chemical processes. The personal element in connection with the history of the company has provided contentious incidents and animadversions, and we need not discuss this feature of the case, though it undoubtedly contributed to the failure of the process; nor is it desirable to speculate as to the existence of any other commercial motive than the desire to establish a profitable business when the process was first financed. The works at Middlewich are situated on the Cheshire salt basin, and the brine is pumped direct from the wells to the cells. The anodes are gas carbon, at which the chlorine is evolved, and the cathode consists of copper-wire cloth, against which rests a diaphragm of specially prepared cement. The liquor percolating through the diaphragm contains hydrated oxide of sodium, but in practice the cathode chamber is filled with carbonic acid gas with the resulting production of sodium carbonate solution. By evaporation in vacuum-pans, soda crystals are obtained, and from the remaining mother liquor the bicarbonate of soda is extracted. The soda and chlorine products are of better quality than those of the old Leblanc and Weldon processes used by the United Alkali Co. and others, and may be generally stated to be equal to the soda pro-

ducts of the Solvay ammonia soda process used by Brunner, Mond & Co., and to the products of the Castner-Kellner electrolytic process, which employs a mercury cathode. An electrolytic process has the *prima facie* advantage of utilizing all the chemical constituents of the sodium chloride. In the Solvay process only soda is produced, and all the chlorine passes away as chloride of calcium or of magnesium, and in the Weldon process only half the chlorine is recovered. Unfortunately, chlorine and bleach are produced in greater quantity than is required in the market, and they are considered both in England and on the Continent as by-products to be sold at any price obtainable. Comparing the various processes, the cost of operations and the poor quality of the products are against the Leblanc-Weldon. The cost of current is the chief item with the electrolytic processes. The difficulty with the Solvay process has been to make it work. The reaction of the Solvay process was known nearly a hundred years ago, but the difficulties in connection with the loss of ammonia and in the design of efficient plant were not surmounted until 50 years afterward, and the present perfection of the plant and process is due almost entirely to the late Ludwig Mond and his staff of chemists. Now that losses of ammonia are prevented and the plant kept efficient, the cost of operation is low. The brine is saturated with ammonia, and carbonic acid gas introduced, the result being the formation of bicarbonate of soda and ammonium chloride. The former immediately crystallizes from the solution, and is removed and calcined with the production of soda ash. The remaining liquor is beaten with lime or magnesia for the recovery of the ammonia, and the waste product is the chloride of calcium or magnesium. It will be seen that the only extraneous material required for the reactions is limestone, in addition to the coal that is required for generating carbonic acid and producing the lime or magnesia, and for maintaining the heat

and the circulation. No information has ever been divulged as to the economics of the process, but it is obvious that the cost must be far less than in an electrolytic process, where much power is required for the generation of the current. It is clear, therefore, that the efficiency of the power-plant used in connection with an electrolytic process is of prime importance. When the Hargreaves-Bird process was introduced, the horizontal boiler and the low-speed horizontal steam engine were in vogue, and the cost of current was a half-penny per kilowatt-hour. Large gas engines were not developed, and the steam-turbine was unknown. The same old plant is still being used at Middlewich, though it is true that in an extension four years ago gas-engines were adopted. The efficiency of the steam-plant has been gradually deteriorating. The Castner-Kellner company had the same start, but fortunately the controllers were able to raise funds for modern power-plant, and to vastly extend the scale of operations. That company had the additional advantage of owning Castner's process for making metallic sodium, and to be able to go into partnership with the Cassel Cyanide company of Glasgow, in connection with the manufacture of sodium cyanide. The latter process was also one of Castner's inventions, and consists of passing gases containing ammonia over metallic sodium, and subsequently bringing the sodamide thus formed into contact with hot carbon. Cyanide is a more profitable salt than soda, so it is no wonder that during recent years the Castner-Kellner company has greatly advanced its profits. The Electrolytic Alkali Company is, therefore, hampered all round. Its products are of low price: it is working with an inefficient steam-plant at a cost four times as great as is possible by modern practice; and its output of soda is not one twenty-fifth of that at Brunner Mond's. The cost of electrolytic dissociation may be gauged by the fact that an installation of 2200 kilowatt capacity

is necessary for its present yearly production of 13,000 tons of bleach and 18,000 tons of soda crystals. It is no wonder that the company is to be wound up, and that the property has passed into the hands of debenture holders. The chief shareholders are unwilling to submit to a reconstruction involving the provision of new capital, and the indications are that operations will be suspended unless the debenture holders can find the money themselves. We have written at some length on a subject that may be considered as outside the scope of this magazine. Nevertheless we hold that the case of the Hargreaves-Bird is a useful object lesson to metallurgists who are inclined to try electrolytic methods in contradistinction to purely chemical reactions. To put it briefly, an electric or electrolytic method is of no economic value if the products are of low price, even when the current is extraordinarily cheap and the operations conducted on a big scale.

An Explanation.

We were asked recently if we expected to serve as a benevolent providence or a kindly grandmother to the inexperienced and unintelligent among shareholders. The idea suggested evidently was that our effort to elucidate mine valuation and to improve mine administration was unavailing, if not indeed inadvisable. We found the question neither annoying nor unreasonable. It is well not only to ask, but to face, such searching queries occasionally. We shall reply to the question *coram populo*.

The assumption that shareholders are unintelligent begs the whole question. We grant that the amount of accurate knowledge extant on mining is not oppressively large, and by the time it filters to shareholders, or even directors, it has dwindled to a feeble drip. All the more reason that such of it as does reach these recipients should be clarified. We serve as a filter, not a vacuum but a pressure filter.

Again, shareholders are more knowing than they used to be. Some measure of acquaintance with mining affairs has spread to the public, and it continues not only to spread but to fructify in signs of increasing intelligence. The effect is not only beneficial as safeguarding the pockets of our fellow citizens, but it has, it appears to us, an equally beneficent influence in raising the tone of the profession that stands between the public and the promoter. An increase of sagacity in speculation, and a growing appreciation of the basic facts underlying the making of money from metallic ores, has tended to an enhancement of the status accorded to the mining engineer, and to a general rise in the code of conduct observed in the financial dealings involved in the operation of mines. No; we do not expect to save the fool from his folly, to protect the simpleton from the sharp, or to introduce Sunday-school ethics into the bucket-shop. That is none of our purpose. Nor is this magazine a financial periodical: we only touch upon financial affairs when they interlock with technical operations. We do not desire to enter a field for which we have no special fitness, and no predilection, leaving it to our capable daily and weekly contemporaries, of whom the number suffices. No, we aim to have this magazine recognized as the organ of the mining profession in London. We expect also to provide intelligent speculators with advice that will enable them to act more sanely; we expect to sustain those directors who realize the responsibility of a trustee: and we expect to give honourable prominence to mining engineers exhibiting a sense of the true professional spirit, which is to do a piece of work well for its own sake. In these matters only the optimist is effective. Counsels of imperfection are pitiful. We must have ideals, not not so far beyond actualities as to be visionary, but far enough in advance to direct the aim of earnest men. These have ample reason for confidence in further progress. We

remember the time when spoofery was normal and trickery almost good form in mining affairs. Both now demand an apology. The whole tone of the business has risen several degrees, and for that improvement the technical press and professional societies can claim some share of credit. Yes; we feel cheerful as regards the effectiveness of journalism as a criticism of current affairs. That is its proper function. In the performance of it we are receiving the support of some of the best men in the mining and metallurgical professions. If all of them are not willing to give a hand, it is because an amiable inertia or a constitutional scepticism causes them to look on, not without a little amused contempt for those who essay the difficult task of the reformer. However, that does not greatly matter. The logic of events is stronger than the smile of the reactionary. Since we have known the business of mining it has improved enormously, not only in technology but in ethics. This last may be too high a name for a vague rule of conduct, but for the sense of right-doing no word is too fine. We appeal over the heads of the timid, the complacent, and the sceptical to the younger men of the profession, to whom belongs the future.

Professors and Practitioners.

The regrettable resignation of the professor of metallurgy in the Royal School of Mines, and the necessity for finding a fit successor, brings to the front again a subject of great importance, concerning which the ideas of most people are, we believe, somewhat confused. Of late years the demand for practical teaching has led to a new departure, an effort being made both in England and America to secure the services, as professors, of men taken from active technical practice, that is, mining and metallurgical practitioners. This effort is the outcome of a call for 'practical' teaching, the idea being that only those who have managed mines and mills are competent

to give the effective instruction that prepares students for the realities of an industrial occupation. Those responsible for the selection of professors became impressed with the inadequacy of lectures delivered by men who have never been at work in the field, and who, therefore, fail often to realize that the eventual purpose of the mining and metallurgic arts is to make money. In short, academic teaching was deemed unsatisfactory. Hence the new departure, which in turn threatens its own dangers. If expert metallurgists and mining engineers are not made in a day, no more are effective lecturers. The danger exists that the eminent practitioner may take two or three years to acquire the ability necessary to instruct a large class of students. Again, the fact that a man is an authority on the cyaniding of gold ores, for example, does not necessarily involve aptitude to teach the general principles of metallurgy or to lecture upon those phases of the subject with which he is unfamiliar. Likewise an engineer deeply versed in South African mining methods is not necessarily equipped to explain the varied mining practices developed in other regions and under wholly different conditions. The new movement has suffered from yet another defect: the eminent practitioner is usually a man of advanced years, for whom, therefore, a long term of service as professor is not to be anticipated. Even if he possesses unusual mental vitality, it is unfortunately a general rule, in England at least, that he may be called upon to retire at 60 years of age, and he must retire automatically at 65. No matter how brilliant and effective he may prove to be as a professor, he must give up his work on the strike of the clock. Thus continuity of teaching is impaired. A new man has to be broken to harness. This may prevent monotony, but it does not promote progress.

On the other hand, despite the liking that all of us have for the man that has done things, and not only talked about them, there remains

a good deal to be said for the well trained teacher who never managed a mine or ran a smelter. To be able to teach, requires a perfect familiarity with the elements of the sciences involved in the subject, though it does not involve encyclopedic information or scientific profundity; it demands also the ability to convey a fund of ascertained knowledge from one man to many students. He who knows the most is not always the one best able to transmit knowledge. The teacher of mining or metallurgy is not required to qualify young men to run mines or smelters; his duty is to give a lucid exposition of the scientific principles underlying the successful application of the arts of mining and metallurgy. Elementary science is the most difficult of all to teach; and the practical man is likely to be ill fitted for the task because his knowledge of the elements lies buried under accretions arising from the more advanced applications of the subject. On the other hand, no lectures give the so-called practical training of which many speak so glibly. That practical training comes only from the apprenticeship to which the young man devotes himself as soon as he has received his academic diploma. To expound mining or metallurgy, it is not so necessary to be a specialist in one branch of either art, as to have a firm grasp upon fundamental principles. This can be acquired by reading, supplemented by frequent visits to mines and smelters, always provided the teacher, who makes such an effort to equip himself, has the devotion of a student and the instinct of a teacher conjoined in him. In writing, the first rule is to remember the reader; in lecturing, the first rule is to remember the hearer. Great teachers are individuals of keen sympathy and quick understanding of the mental processes of those whom they are trying to teach.

The foregoing considerations lead to a practical conclusion: in default of a man who is both an experienced practitioner and a cap-

able lecturer, it is best to incline toward the latter. We would rather see the authorities engage a young and promising teacher than an old and experienced practitioner. The latter has a short period of service, and is, at best, an experiment; the former is no experiment as a lecturer, and as regards his closeness of touch with working practice, it is always possible to correct a deficiency by arranging for visits to works and mines during vacations. A teacher must also be a learner; no man can expect to keep in touch with a progressive subject unless he also continues to be a conscientious student. If the young teacher fulfils his promise, he will grow with his work, and become increasingly efficient, assuring the School a long and continuous professorship. But to perfect this arrangement it is incumbent upon the authorities to give him the financial facilities for making journeys of observation, while, at the same time, discouraging professional practice in competition with the ordinary practitioner, to whom he must look for cordial assistance. It has been asserted that professors of mining and metallurgy can keep themselves up-to-date by engaging in practice during the intervals of teaching. This we believe to be a mistaken idea, because outside work may be remunerative without being instructive; it involves participation in commercial enterprise of a speculative character; it means competition with, instead of the hearty co-operation of, the unattached practitioners. A man who does want to keep abreast of the times can get far greater variety of experience by inspecting the work of others, as explained by those others; he can choose his own time; he can select the kind of work in which his knowledge is deficient or that in which new developments illustrate his teaching. We submit these views to our friends at South Kensington, being at one with them in the desire to see our School of Mines brought to the highest pitch of efficiency.

PERSONAL

J. A. AGNEW has left for New York.

A. CHESTER BEATTY has arrived from New York.

HERBERT BLACK has returned from the Sefwi goldfields, West Africa.

T. BOWYER BOWER arrived in West Africa on May 7.

H. T. BRETT has left Bulawayo for Australia, on a short holiday.

W. M. BRIWER has returned to Victoria, British Columbia, from Valdez, Alaska.

R. GILMAN BROWN has gone to Siberia.

GERALD M. BROWNE, of Pearse, Kingston & Browne, is in Venezuela.

COLIN CAMPBELL has left London for Salisbury, Rhodesia.

JACOBUS STEPHANUS CELLIER, Mining Engineer and Government Land Surveyor, has been appointed Professor of Mining in the South African School of Mines and Technology.

J. PARKE CHANNING is in temporary charge of the Miami copper mine, Arizona, during the illness of the manager.

J. E. CLENNELL has left Mexico, and is living at Oakland, California.

H. N. G. COBBE has returned from British Guiana.

ROBERT E. CRANSTON has returned to San Francisco from Brazil.

T. L. DAWSON has returned from Colombia.

ARTHUR DICKINSON sailed for West Africa on May 3. He is engaged to be married to Miss Irene Ker.

DAVID DRAPER is here from South Africa.

H. S. DRINKER is visiting Panama.

H. THURSTON EVANS, of Melbourne, has been appointed manager for the Salak South Tin Dredging Co., Selangor, Federated Malay States.

CYRIL EMBRY is in charge of the British Broken Hill mine during W. H. Woodhead's visit to London.

A. M. FINLAYSON is on his way back from Burma, by way of the United States.

ANDRE P. GRIFFITHS is at El Oro, Mexico.

NOEL G. HACKNLY has returned to London from Venezuela.

RICHARD HAMILTON has been re-elected president of the West Australian Chamber of Mines.

W. CHARLES HAND sailed for Nigeria on April 30.

J. POWELL HARDING is returning from Johannesburg in May.

G. A. HARRISON has left London for Siberia.

LIONEL HILL is home from British Columbia.

CHARLES JANIN is in France.

H. A. KELLER passed through London, on his way from New York to Germany.

GEORGE L. KERR has been appointed secretary of the Mining Institute of Scotland.

CHARLES KIRCHHOFF sailed from New York for Europe on April 12 for a visit of several months.

ERNST LICHTENBERG has returned from the south of France.

W. J. LORING has been in West Australia, and is now in Melbourne.

E. P. MARTIN has been appointed lecturer on mining in the Charters Towers School of Mines.

D. MICHAUX is visiting the silver-lead district of Arufu, Northern Nigeria.

E. D. McDERMOTT is returning to Tanalyk, Russia.

C. H. MUNRO has returned from Peru to New York.

H. G. PAYNE is consulting engineer to the D. S. R. Syndicate, operating in Northern Nigeria.

W. PELLEW-HARVEY has left for Cobar, and will visit Western Australia on his return journey.

WALTER G. PERKINS has returned from the Argentine.

R. ALLISON PURVIS was married in March, while on leave from the Spassky mine, Siberia.

R. J. D. RICHARDSON has arrived from the Gold Coast.

T. A. RICKARD sailed on May 2 for New York, to deliver a course of lectures at Harvard.

W. S. ROBINSON has returned from Australia.

S. J. SPEAK, of Hooper, Speak & Co., is on his way to Rhodesia.

HENRY C. TAYLOR has returned from India.

SCOTT TURNER, manager for the Arctic Coal Co., has returned to Spitzbergen.

H. L. VENABLES is expected in London from Bolivia.

A. R. WEIGALL is in Korea.

ERNEST WILLIAMS has returned from Spain.

C. H. WRAY is in Cornwall.

ARTHUR YATES, late manager of the Ketahoen gold mine, Sumatra, has returned to England.

SPECIAL CORRESPONDENCE

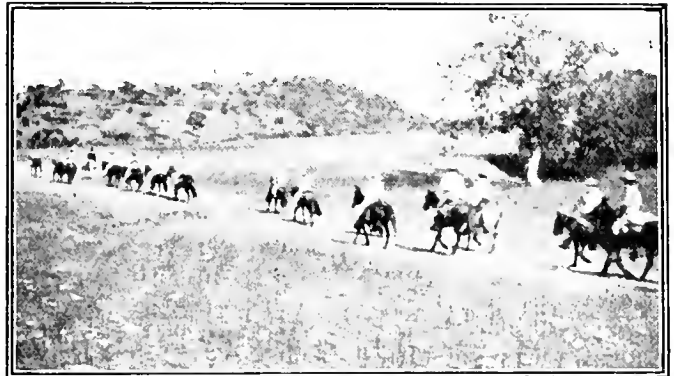
News from our own Correspondents at the principal mining centres

MEXICO.

General Conditions.—Notwithstanding the fact that the states of Sonora and Coahuila are in revolt, and the possibility of their secession from the Republic has been suggested, and also that in some parts the depredations of bandits continue much as before, affairs in Mexico have now a more hopeful aspect than at any time during the past year. Huerta was the most successful and energetic of all the generals under the late government—so much so, that his methods were considered too severe by Madero, who ordered his recall—and his recent work gives at least a fair promise of a final settlement of disorder. There is no doubt that the army, and a large majority of the better class of people, are entirely with him, and the reception of his plain and business-like speech at the opening of the Congress, shows that he has the power of raising enthusiasm for the work of pacifying the country. Several bands of revolutionists have surrendered and enlisted in the army, and although one detachment quickly tired of the discipline, killed their officers, and took to the hills, the general results of this method have been satisfactory. Orozco, the leader of the revolt in Chihuahua, has sent envoys, under his father, to confer with the bandits of Morelos, who are under the nominal leadership of Zapata, as to the terms on which they should agree with the new government. This showed defective reasoning power on his part. The Morelos outlaws are the most ignorant and savage of all, and the idea of anyone trusting them for a moment must have appealed to them as a rich jest. The envoys were promptly made prisoners, and, it is reported, murdered without delay. The incident may lead to an arrangement between the Government and Orozco by which the men from the north have the work of pacifying—or rather, exterminating—the bandit element in Morelos. The formal recognition of the Government by the larger Powers, and the flotation of the projected loan in Europe, would indicate the re-

turn of Mexico to the ways of peace in the near future.

The Mezquetal del Oro company, in the state of Zacatecas, is adding a slime equipment to the cyanide plant. A large proportion of slime was lost under the previous method of percolation treatment, and it is expected that the new plant will collect a high percentage of the gold in the ore. The mine has produced many bodies of rich gold ore, and has been the Mecca of ore-thieves in past years. The long work of exploration for bonanzas has opened up an enormous tonnage of low-grade ore, and during the past few years, dividends have been paid steadily on a daily output of about 150 tons, averaging five



Engineers and Escort going to Campo Morado.

to six grammes of gold per ton. The costs can be considered the lowest for gold mining in Mexico, being slightly less than four pesos per ton, and the regularity of the value and percentage of extraction allowed the small margin of profit to be calculated almost exactly. The mine has the advantages of a hard country-rock and soft ore, a stopping-width that averages 12 feet, and the absence of the necessity for hoisting or for timbering to support the walls. Although the extensive development of the mine and extraction of the richer portion has left it in its present impoverished condition, it is by no means certain that the bonanzas are entirely of the past.

The Cinco Señores mine, in the state of Guanajuato, reports a strike of bonanza ore on the 140-metre level, which has been driven

for a year on barren vein-material. This has also been famous for rich patches of ore which have been invariably found between 50 and 150 m. in depth, and although exploration has been carried on extensively below this horizon, it has been practically without result. The official report of the Mexican board of directors is that the ore assays from 20 to 60 kilo. silver and from 7 to 100 gm. gold, but no dimensions are quoted to corroborate the statement that the new find has a value of three million pesos.

Although all terms and conditions have been settled in connection with the Campo Marado-Camp Bird deal, the final settlement is still in abeyance owing to the disturbed state of Guerrero. The late surrender of the revolutionists in the state, and their enlistment as *rurales* under their former chief Salgado, may lead to the commencement of work there within a month or two.

JOHANNESBURG.

The Van Ryn Deep should be in a position to drop a few of its stamps in June, as the erection of the reduction plant has made excellent progress of late. The mill consists of 80 stamps of 1900 lb., and 8 tube-mills each 16 ft. 6 in. by 6 ft. The cyanide plant comprises 3 collecting tanks, Blaisdell distributor, 5 treatment tanks, Butters filter-press, and the usual accessories. The capacity of the whole plant will be 40,000 tons per month, equivalent to a stamp duty of nearly 20 tons per day. If the underground lay-out was as straightforward as the surface arrangements, the future of the property would be a much brighter one. Unfortunately dikes and faults have played havoc with the development and shaft-sinking programme, and have proved, and are likely to continue to prove, a serious handicap to tractable mining. Apart from this unavoidable feature, which it is hoped will become less noticeable with depth, everything promises to furnish a satisfactory record. The assay-value of the ore developed has been steadily rising, as is shown by the quarterly development figures. Taking the quarters of 1912 in their order, the assay-values of the tonnages developed, after allowing for removal of waste after mining, were, 6'48 dwt., 10'18 dwt., 9'00 dwt., and 10'24 dwt. respectively, and the total profitable tonnage developed to the end of the year was 1,015,932 tons, averaging 7'95 dwt. The depth of the workings is about 1800 ft., the dip of the reef 15°, and the profitable ore is practically confined to the Main Reef. Brakpan, the classic reference,

lies directly on the dip, and as the geological conditions in its area have so far been normal, the prospects of the Van Ryn Deep in depth are the more encouraging. Another cheerful portent for the future is the fact that the eastern area, which should be the richest, if the evidence of the outcrop properties is any argument, is as yet untouched. The company has an issued capital of £1,196,892, an area of 764 claims, and funds in hand ample for all ordinary contingencies.

The Far East Rand pursues its onward and, on the whole, triumphant march of progress. At the Springs Mines the north shaft, the sinking of which commenced in March, 1909, intersected the 'reef' at a depth of 3432 ft. in March, 1913, the assay result being 5'95 dwt. over 34'9 in. The reef had of course been previously proved by boreholes, the nearest one of which returned a value of 28'42 dwt. over 18'56 in. The nearest producing shaft is the No. 2 of the Geduld, 3½ miles away toward the outcrop, while Brakpan is 5 miles, and the outcrop 5¾ miles away. The south shaft of the Springs Mines is distant from the north shaft 4500 ft. to the dip, but as the reef here dips at the low angle of 5° there should not be a great difference in the respective depths to reef; the intersection may be expected to take place, therefore, about July. The company has an issued capital of £630,000 and 165,000 shares in reserve, and on proclamation of the firm it will be entitled to 1160 claims. At the close of 1912 there was a cash balance of £50,000, which should be sufficient to carry on till July.

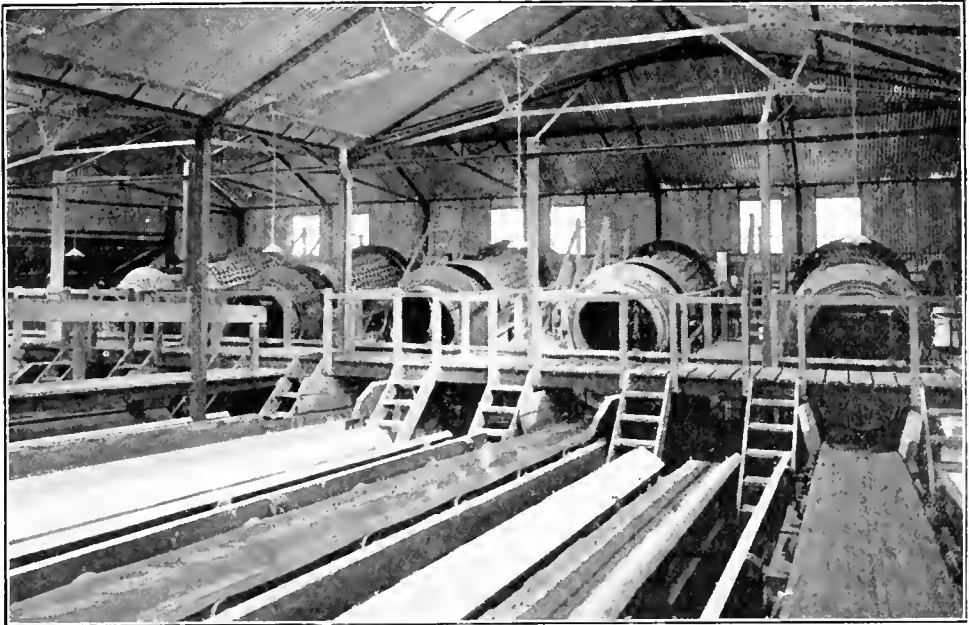
The Brakpan has received a set-back. In March caving took place in no less than five stopes, rendering them temporarily unavailable, an incident which points to the desirability of affording more support to the hanging than is the practice at present. A drop is noticeable in the development results for the first quarter of the year from an average of 9'36 dwt. over 37'67 in. in 1912 to 7'8 dwt. over 37'6 in. The ore-reserve position, however, continues sound, and at the end of 1912 it amounted to 2,457,000 stopping tons of 6'74 dwt.

Brakpan-Schapenrust.—The apathy of financiers toward the Brakpan-Schapenrust mining lease was in sharp contrast to the keenness shown by them when the Modderfontein Gold Mining Areas lease was offered by the Government. The first offer having proved a failure, the Government is again submitting the area, but on slightly less onerous terms; and undaunted by the attitude of indifference of the groups it is also offering a lease on an ad-

joining area forming part of Witpoort. It is doubtful if either of these leases will receive attention. The overseas public at the moment can find industrial and other stocks which promise them a safer return than deep-level mining seems to offer.

The Rand Klip having failed to find any appreciable amount of profitable ore in the course of development has shut-down, after taking the wise precaution of earmarking about £10,000 of its working capital to enable it to preserve its independence through the long despondent days ahead of it. In the waiting

position by the reduction in capital expenditure from £308,138 to £215,685. It will be noted on referring to the report that the balance of appropriation account is divided into cash and cash assets, thus affording shareholders a chance of seeing for themselves how much of the balance is tied up in bolts and nuts and how much is liquid in the shape of coin. This disentanglement is generally confided to the care of the chairman of the meeting in order to give him something to talk about, or it is left to shareholders to worry out for themselves, if they can. The notable



THE BLAKPAN SORTING-HOUSE.

business it will keep company with Cloverfield.

The East Rand Proprietary, considering all things, made a remarkably good record during 1912. The figures show the following variations as compared with the record for 1911: the yield per ton from current ore rose from 25s. 4d. to 32s. 1d., the working cost from 16s. 8d. to 20s. 10d., the working profit from 8s. 9d. to 11s. 3d., and the net profit from £895,442 to £909,108. The dividend decreased from 30% to 25%, but as against this reduction the company took time by the forelock by buying £53,000 of debentures in the open market, writing off the balance of debenture issue expenses, £68,712, and carrying forward a cash balance of £64,317. A large amount of relief was afforded to the cash

increase in the yield is explained by cleaner mining, reduction of stoping widths, closer sorting, etc. The average stoping width was reduced from 67 in. to 53 in., a reduction equivalent to an increase in the value of the ore mined of 5s. It is notable that 75,000 tons of rock that might have been considered as ore was dumped and 9000 tons packed in stopes. In consequence of closer methods, the tonnage crushed fell from 2,194,552 to 1,848,050, while the working cost and yield rose, the result on balance being decidedly in favour of the selective as against the wholesale method of mining. Development during the year gave much the same results as in 1911 as regards the value of the total footage sampled, but the percentage of profitability rose from 55% to 58%. The profitable ore de-

veloped amounted to 1,029,016 stope tons averaging 8.2 dwt.; it is noticeable, however, that in spite of this accession the average content of the ore reserve did not appreciate, in fact, it dropped slightly. The ore reserve at the end of the year was 6,013,300 stope tons averaging 6.8 dwt. Development was hampered on account of the inadvisability of cutting through the Wit. Deep dike until the big pumping plant was fully installed, but the consequent decrease in the tonnage developed was provided for by the balance of £127,679 standing to the credit of the development suspense account. There is in this connection some concern as to how long development will continue to be restricted in the good Driefontem section owing to this waterlogged dike, for even after the pumps are ready the draining process may take a long time, and in the meanwhile the leeway to be made up may grow to a seriously uncomfortable extent. It is disappointing to note that the experiments made with small rock-drills of the hammer type proved that the golden harvest awaiting the manufacturer of rock-drills is still un-reaped, and that the machine is yet far from being a serious competitor of the hammer boy. On account of the steep stopes of this mine the small reciprocating rock-drill, weighing 180 lb., is ousting the large 320-lb. machine. The evidence of roof pressure in the Angelo section has led to the introduction of sand-filling there, and no doubt this means of securing ground will be more employed in the future. The risk attending the preservation of the present inclined shafts throughout the life of the mine is a serious matter. Concentration of underground operations will gradually take place until the Hercules shaft and the Angelo Deep west shaft become the two main hauling shafts of the property, with the 27th level as a main transfer road. Besides safety this scheme will have economic advantages over the old one of secondary inclines from the plane of the bottom of the main inclines.

The Cinderella Consolidated has had to face a number of unpleasant and unprofitable situations during its four and a half years crushing history, prominent among which have been single-shaft working at a depth of 4000 ft., and those interesting but discomfiting geophysical demonstrations, 'air-blasts.' Single-outlet working necessitated a legally restricted scale of operations and conditions underground which have not made for popularity among workers, and the adverse influence of the air-blast was clearly shown by the monthly work-

ing profit dropping from £4058 to £104 in July of last year. It was generally expected that when connection was made to the Cason shaft of the East Rand Proprietary Mines on December 1, 1911, thus affording a second outlet and thereby removing the legal restriction which limited the number of miners, working results would materially improve, or at least that the retrograde tendency would be stayed; but this hope has not been fulfilled, and instead the rate of retrogression has been so accelerated that the directors of the company have had to consider seriously whether or not it would be in the best interests of shareholders to suspend operations until the mine could be put into better shape for supplying the mill at a more reasonable cost. The following comparative figures, taking the year 1909 and the month of February 1913, will show the direction in which the mine has been steadily trending. The yield per ton has dropped from 29s. 2d. to 26s. 6d., the cost per ton has risen from 21s. 8d. to 27s. 4d., the working profit per ton has receded from 7s. 6d. to a loss of 10d., and the total monthly working profit has dwindled from £4939 to a loss £725. The figures for February (and those for March are almost as disappointing) make it apparent that a change must take place soon if the mill is to be kept running. The mill consists of 100 heavy stamps, of which 80 are running, and 3 tube-mills, and has a capacity of 25,000 tons per month; the present rate of crushing is 19,000 tons. As the company owns 2101 claims with a strike 3 miles long, and has an issued capital of £1,159,450, together with a debenture debt of £500,000, it is obvious that the current scale of operations is insignificant compared with the mining area, and that current losses constitute a wretched return on so large an outlay. So far, only the extreme northwestern corner of the claim-area has been touched, but the new central 7-compartment vertical shaft, which is situated a mile to the east of the western shaft, has reached a depth of 2500 ft. and the 'reef' is expected at a depth of 3000 ft. toward the end of the year. It is hoped that the two shafts will be connected within eighteen months, and that this will provide a more promising prospect for the company. The intention is to gradually increase to a capacity of 100,000 tons per month, and ultimately to 200,000 tons. The cash resources amounted to £343,057 at the end of 1911, and as capital expenditure absorbed £153,849 during 1912 and will absorb another large slice in 1913, it is difficult to see where the money is to come

from for the contemplated large addition to the plant. It is sincerely to be hoped that a brighter financial horizon will permit of the disposal of the 190,550 reserve shares at a good figure and thus enable the company to realize its destiny. The ore reserve at the end of 1911 was 740,157 tons, averaging 6.73 dwt., or 28s. 6d. per ton, but this of course represents only the value of one little corner; practically nothing is known as to the contents in the greater depths. Besides, the bulk of the remaining untouched lateral extent of claim area lies to the dip of such doleful neighbours as the Blue Sky, New Boksburg, and East Rand Extension. The future, therefore, has well defined speculative elements.

The Water Position has been causing anxiety owing to the small rainfall this summer; it has been the worst season on record and at least another 6 in. is required before the winter months can be faced with equanimity. Misgivings are not confined to the municipalities which obtain their water from the Rand Water Board, but extend to the mines, many of which rely upon the Board to keep them supplied. The importance of the matter of supply to the mines can be readily understood when it is mentioned that the industry took 125 million gallons of the total of 235 million gallons sold during February. The position is aggravated by the meagre contents of the mine dams, these being now only half full. The Government has refused the Board permission to pump water from the idle shaft of the Western Rand Estates as it is feared that such a procedure would diminish the flow of the Mooi River, and thus interfere with farming operations in the valley. In consequence of the difficulty of finding new sources of supply near at hand, a Bill is in preparation for presentation to Parliament to enable the Board to construct a dam and draw water from the Vaal river at Vereeniging.

Miners' Phthisis Board.—The report of the Board for the six months ended January 31, 1913, is not cheerful reading. The number of applications received was 2413; the number of miners who made application was 1819, and dependents of deceased miners, 594. There appears as yet to be no diminution in the number of applications coming forward, as is shown by the number received during January, namely, 345. Of the 1468 awards made, 922 were annuity awards, that is monthly payments of £8 per month to miners or dependents. Of these awards, 119 did not exceed £96. The number of single-sum payments was 546, of which 222 did not exceed

£96; 289 miners and 3 dependents of deceased miners were repatriated. The lowest amount awarded in a lump sum to a repatriated miner was £175. A special schedule dealing with 200 cases selected at random from the beneficiary miners shows clearly the rapidity of action of the disease. A miner with 9½ years' underground service, whose expectation of life under normal circumstances should be 26 years, has 1½ years to live; with 4½ years underground, normal life expectation 27 years, has 3½ years to live; with 3 years underground, normal expectation 31 years, has 3½ years to live. The report says: "The remarkable feature of the figures shown on this schedule is the appalling decrease of the underground miner's expectation of life." A perusal of this report is calculated to make the reader wonder how so many men can be found light-heartedly to face such a danger.

NEW YORK.

The Tariff.—The impending changes in the tariff schedule were a prime topic of interest during April. When the bill was finally made public it excited great interest for a day or two, but had scarcely any effect upon Wall Street, and after a few days declined as a topic for discussion. Probably this is in part due to the fact that the market had completely discounted a sweeping reduction in duties, and was therefore unaffected when the bill was introduced. In its general provisions the import duty is lowered or removed on all those commodities which can be classed as necessities, while unchanged or raised upon such articles as may properly be regarded as luxuries. The chief changes in the metal and mineral schedule are the reductions upon iron ore, iron and steel, and iron manufactures, the changes in the lead and zinc rates and the change in quicksilver. It is generally agreed that the changes in the iron ore, iron, and steel schedule will most benefit the independent producers, though probably no great effect will be noticeable. Iron ore, steel rails, tungsten ore, and a variety of manufactured products have been put upon the free list, as have a number of products classed as chemicals, including sulphur and bituminous coal. As a result of the changes from fixed rate per ton to an *ad valorem* impost, the duty on ferromanganese has been increased \$5 or \$6 per ton. This is to the benefit of the Steel Corporation, since practically all of the ferromanganese produced in America is made by the Carnegie and Illinois Steel companies, and is used by the plants of the Steel Corporation. The probable and de-

surable result of the increased tax will be to stimulate the manufacture of ferromanganese within the borders of the United States. Imports in 1911 were valued at over \$3,000,000, and as manganese ore, which chiefly comes from India and Brazil, is admitted free of duty, there is no reason why this essential ingredient in steel-making, as well as other ferro-alloys, should not be manufactured in the United States. There has been a tendency among American manufacturers to concentrate upon an important product, allowing by-products to go to waste, while purchasing from other firms or abroad any minor supplies needed in the manufacture. The present tendency is, however, toward intensive work, similar to that in the Chicago packing-houses, where in slaughtering and dressing hogs everything is utilized "except the squeal." The Gary plant of the Steel Corporation is an example of this tendency, and it is to be hoped that it will increase.

In the lead and zinc industry protest is being made against the change from a fixed rate per ton to an *ad valorem* duty. On the *ad valorem* basis the amount of protection accorded the home producer decreases with the decrease in the price of the metals, just the reverse of what he desires, since the foreign producer, with lower operating costs, is able to keep going on a narrower margin than the American smelter can. This provision may be changed in the bill as finally presented. The duty upon quicksilver is to be reduced from a rate of 7 cents per pound to an *ad valorem* of 10%, amounting on the average to about 6 cents per pound. The amount of change is insignificant, as quicksilver frequently commands a higher price than sixty cents per pound, but the American producer strenuously objects to having the protection decreased when he is contending with low market prices. Producers in America now supply the domestic demand, with merely a small and fluctuating amount for export. The control of the quicksilver industry abroad is in the hands of the Rothschild interests, so that the independent small producers of the metal in California apparently have good ground for clamouring for protection from the power of foreign monopoly. Unfortunately for the success of this plea it has recently appeared that the Quicksilver Mining Co., which operates the New Almaden mines, once the most important producers in the United States, but now greatly declined in importance, has been under investigation by the Department of Justice of the United States Government. The natural inference is that there has been collu-

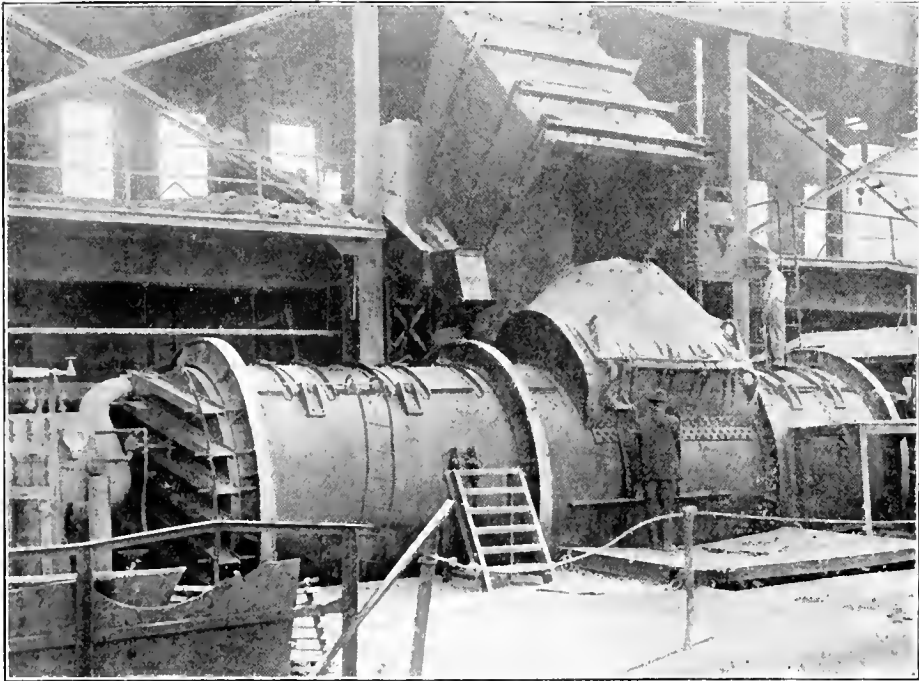
sion between quicksilver producers here to maintain prices, so that the independents are apparently not so helpless as would otherwise appear.

Recent legislation in New York State is of much interest, since New York City is the centre of mining in the United States, just as London is the centre of mining for the British Empire. There is a wide-spread demand that unwary investors be provided some protection against the operation of wild-cat companies, and the Goldberg bill creating the office of Examiner of Securities is intended to afford such protection. Companies wishing to sell securities must file with the examiner certain statements. Upon examination of the statements he is to issue a license permitting the concern to offer securities for sale "if he finds that such company is solvent, that its articles of corporation, its constitution and by-laws, its proposed plan of business and proposed contract, contain and provide for a fair, just and equitable plan for the transaction of business, and in his judgment promises a fair return on the stocks, bonds and other securities by it offered for sale." Wall Street disapproves of the law, on the ground that the arbitrary power thus conferred is dangerous; only omniscience can infallibly decide whether a company will succeed or not; and that the statement that the security has the approval of the state authorities will be used to further the sale of securities which are just above the margin of doubt. The Levy bill, which has recently become law, provides that "any person who inflates, depresses or causes fluctuations of the market prices of the stocks, bonds or evidences of debt of a company or association," or who attempts or conspires to cause them to fluctuate shall be guilty of felony. A pretended purchase whereby no change of ownership or interest is effected is regarded as *prima facie* evidence of violation of the law. The law is, on its face, an excellent one, but recalls the recipe for rabbit stew, for it is not at all clear how incontestible evidence of manipulation of securities can ever be secured, since actions of this sort must necessarily be secret and furtive. But the placing of such a law upon the statute books may have a salutary effect upon public opinion, which is still decidedly lax in this regard.

Porphyry Coppers.—Reports of three large 'porphyry copper' companies appeared on April 18. The Nevada Consolidated earned \$10,589,150 gross in 1910, having produced 63,063,261 lb. copper and \$521,278 worth of gold and silver, at an operating profit of

\$3,281,920, of which \$3,000,000 was paid in dividends. The company has now completely absorbed the Cumberland Ely, that company having been recently dissolved, by court order. During the year, 2,852,515 tons of ore was treated, of an average copper content of 1.692%, the percentage of extraction being 68.25. The total cost of copper production was 8.36 c., reduced by miscellaneous credits to 8.33 c. The cost of mining was 33 c. per ton, including its proportion of stripping cost for open-cut work and the cost of mining underground at the Veteran. Stripping costs were 33.64 c. per cubic yard. The present

ing 1913 even better results should be obtained as the mill is now in full operation, and the steam-shovel work at the mine has advanced to the point where the work can be handled to good advantage. Chino is generally regarded as the best of the porphyry coppers, as it is favourably situated for mining by steam-shovel methods, the topography being such that the amount of overburden to be removed per ton of ore mined is nearly a minimum. One drawback, to which little attention is drawn, is the irregular relationship between the oxidized and sulphide portions of the orebody. The sulphides sometimes overlies and sometimes



PEIRCE-SMITH CONVERTER AT NEVADA CONSOLIDATED.

ore reserve is computed at 38,854,000 tons, containing 1.67% copper.

The Chino Copper Co. yielded 27,776,088 lb. of copper during the year, valued at \$4,344,261. Operating expenses amounted to \$2,132,093, the net operating profit with the addition of \$125,133 other income, amounting to \$2,176,904, or \$2.80 upon each share issued. The company has been operating below its full capacity throughout almost the whole year, as the final unit of the mill was not completed until near the end of the year under review. Nevertheless the average cost per pound of copper produced was only 7.69 c., the average selling price being 15.64 c. Dur-

underlie the oxidized ores, and in developing the open-cuts so as to permit the most economical handling of the ore, it is necessary to take it as it comes, oxide or sulphide. The mill-feed may on one day consist of ore containing chalcocite, native copper, and malachite, while on the next it may contain low-grade sulphides, causing difficulties for the mill manager and for the smelter superintendent as well. The water supply of the Chino is ample, though not excessive. The known ore reserve is calculated at 90,000,000 tons, containing 1.8% copper.

The Ray Consolidated Copper Co. made a net operating profit of \$1,814,206 during the

year 1912, the comparative figures for 1911 and 1912 being as follows:

	1912	1911
Copper produced.....	\$1,467,296	\$3,513,664
Silver produced.....	8,269	7,343
Gross operating income.....	5,475,565	3,521,012
Operating expenses.....	3,661,359	1,554,351
Net operating profits.....	1,814,206	1,666,661
Other income.....	296,760	79,253
Total income.....	2,110,966	1,745,914
Int. on bonds, notes, and adv.....	181,702	115,292
Surplus.....	1,929,262	1,630,622
Previous surplus.....	298,640	298,640
Total surplus.....	2,227,902	1,929,262

Flotation at Inspiration.—Easily first in importance of the events of the past month in the copper world is the announcement that the Inspiration Consolidated Copper Co. has decided to build a 600-ton flotation plant at its mine in Arizona. For some time the Minerals Separation, Ltd., has been conducting tests in a 50-ton experimental plant in order to demonstrate the applicability of oil flotation to the treatment of the Inspiration ore, and the results, though not disclosed, have been sufficiently encouraging to justify the erection of a plant in which the process can be tried on a full working scale. In this case, the ore will be treated by flotation only, not subjected to a preliminary wet concentration, as at the Braden. At the Inspiration the amount recoverable by roughing concentration is not sufficient to justify the capital expenditure required for the purpose. The construction of the wet concentration mill, for which plans were drawn and contracts let, is indefinitely postponed, and bids fair to be dropped, if present indications may be relied upon. If flotation proves completely successful upon the Inspiration ore it will only be a matter of time before corresponding experiments are made upon other copper ores, in Arizona and elsewhere, and if successful results follow in even a minority of cases, the resulting increase in the recovery will cause an increase in copper production greater than the opening of a single big mine. Fortunately such changes come about slowly, giving opportunity for readjustment to the changed conditions. The cost of copper production, which has already been cut by a number of mines below eight cents per pound, is evidently slated for a further lowering.

Chuquicamata. The second big event of the month was the organization of the \$95,000,000 Chile Copper Co. to take over the \$20,000,000 Chile Copper Co. incorporated last year, as well as the \$1,000,000 Chile Exploration. It will handle all the Guggenheim interests at Chuquicamata, in Chile, and

the company was no sooner organized than its capital was increased to \$110,000,000 and \$15,000,000 in 7% convertible bonds issued to provide the funds for development. Daniel Guggenheim is to be the president and A. C. Burrage the vice-president of the new company. It is stated that no shares^o will be offered for public subscription. It is known that there is a large ore reserve at Chuquicamata with a comparatively high copper content, but even at that it is interesting to reflect upon the dimensions of the block of copper required to meet the ordinary interest charges upon \$110,000,000 worth of securities, not to mention amortization. Interest charges alone will demand a gross annual output of over \$20,000,000 worth of copper. Great things are expected of Chuquicamata as is evident from the altitude of its financing. It is interesting to note that the company was organized in Delaware, as the laws of the state of New Jersey, long known as the 'mother of trusts,' are no longer hospitable to large aggregations of capital since Woodrow Wilson was governor of the state. A recent statement, apparently authorized, is to the effect that 100,000,000 tons of 2½% copper ore has been developed, there being 200,000,000 tons of possible ore. Of the \$15,000,000 bonds issued the company will take one-third and the remainder be sold by subscription at par. The ore is to be mined by the aid of steam shovels and leached with sulphuric acid made from sulphide ore.

The Kennecott Mines Co., operating in the Copper River district of Alaska, and controlled by the American Smelting & Refining Co., has had a good deal of publicity in connection with Alaskan affairs. The ore is remarkable for its high content in copper, as it consists of massive chalcocite. In order to develop the mine it was necessary to build the Copper River & Northwestern Railway 195 miles long, at a cost of \$13,000,000. The \$1,000,000 dividend, recently declared, is therefore, not so 'fat' a one as might appear at first thought, for the total expense of developing the mine has been very great, while the total in dividends so far has only been \$4,000,000. However, nearly all the output has been made in the past two years, since the railroad has been in regular operation to the mine, the ore being shipped to the Tacoma smelter. Probably the venture will prove profitable in the end, but the initial burden for development has been a heavy one, and the ore reserve, though rich, is so small that the life of the mine will be exceedingly brief.

MELBOURNE.

Broken Hill.—More than a cloud has arisen on the horizon at Broken Hill. This district today is by far the most important mining centre in Australia. It has clustered round it a population of over 30,000, and its silver-lead mines are some of the best in the world. Then at Port Pirie, in South Australia, a large number of workers are employed at the Broken Hill Proprietary Company's smelters, while further afield there is also a mining population dependent on the district at the Iron Knob in South Australia, and at Bellambi in New South Wales. The traffic from the Barrier adds substantially to the railway earnings of the South Australian system. The mines at the Barrier work under a Federal award. Within the past 5 or 6 years, the workers have succeeded in securing an advance in their wages, which probably means that they receive quite 30% more than they did before that term. They also have been able to secure to themselves a number of important concessions in respect to the methods of working on holidays, and other gains which have a monetary value to the men. The average wage earned by many of the miners per shift on contract work runs up to about 17s. per 8 hours' shift. For a long time past the district has been under-manned, and with everything so prosperous in the Commonwealth, there has been no inflow of labour to the Barrier to induce the men to be moderate in their demands. The red rag of socialism has fluttered there most boldly, and the boycott is an instrument of every-day use by the Unions. So strong is the power of these bodies that they even prohibit their members from attending the race meetings, or they tell their members not to give orders to a tradesman who may have allowed a non-unionist to ring up a doctor on his telephone. There is nothing too extreme or too extravagant for them to demand. Their latest declaration has been on the non-unionists question. There still remain a few of these so-called 'undesirables' in the district, and about a month ago, in order to make them toe the line and join the Unions, the different organizations associated with the Barrier Labour Federation issued a stand-and-deliver resolution that every month there must be a show of pence-cards at the place of working. Then should any man not be able to produce his financial card, members of the Union were directed to refuse to work with him there and then. Should any of the members neglect to do this, the penalty is an expulsion from the Union. This resolu-

tion was not taken seriously at first, but now there is evidence that the Unions mean business, because they have endorsed the action of the organizations that first moved in this matter. Consequently, it can be said that the deliberate intention is to prevent non-unionists living in the Broken Hill district, because it is not a far step for the Unions to say that none of the trades-people shall supply black-legs with the necessities of life.

Action of this kind hardly fits with the award of the Federal Arbitration Court, which said that preference should be given to unionists, all other things being equal. However, the Arbitration Court never worries the Labour Party so long as the leaders feel that they are in a position to enforce their decisions. They use the Court to hurry the employer, and when it does not suit them, they take the law into their own hands and without consulting the Court, adopt a course that ensures to them benefits as against their employer. It was understood that before April 1, when the decision of this non-unionist question was to come into operation, the representatives of the Barrier mines met to consider whether they would fall in with the wishes of the Unions or resist their demands. At the time of writing, it is not known what attitude the companies adopted, but it has been whispered that while some of them were prepared to fight the Unions, others and notably the concerns controlled in London were not disposed to bring matters to a head. Of course the Broken Hill Proprietary Company has nothing to do with the Local Managers' Association since they had to fight the men off their own bat some time since, and the excuse has been made that with the Proprietary not in the conference, no effective action against the Unions could be taken. Whether this is so or not cannot be determined until the issue has been put to the test. What has happened, however, has been that the Unions decided to force the clerical staff of the Silverton Tramway Company, which owns the line of railway connecting the South Australian railway system with Broken Hill, to become unionists. The Unions exempted from their demands the manager, the accountant, and one or two other officials. The stoppage of the railway service really meant the holding-up of Broken Hill by checking all means of transport. However, the unionists propose to get over this difficulty by nationalizing the Silverton Tramway Company's railways and works. This would mean taking from the shareholders of the company their railway line and handing it

over to the control of the labour government of New South Wales, which the other day, when the ferrymen of Sydney went on strike for concessions, started a government service to carry the people. The reason given for doing this was that the public should not be inconvenienced, but the real underlying motive was to bring the directors of the various companies to their knees.

Now it is not a far step from nationalizing the transport service of the mines to nationalizing the mines themselves, and it has not been altogether a dream on the part of many of the labour leaders to ensure the ownership of the Barrier mines to the State. What has to be remembered by company officials outside Australia is that the bulk of the shares in Broken Hill mines are held beyond the borders of Australasia. That being so the people of Australasia are not actively concerned whether the mines are nationalized or not. Indeed, if the matter were put to a large number of them that the profits from the mines would be available for the relief of taxation and the carrying out of public works, it is doubtful if they would worry over the ownership passing into the hands of the Government in New South Wales. It is not suggested that this is a matter of practical politics yet, but the subject is one that should not be lost sight of by directors abroad, who may make the question of dividends their first consideration. If the directors are not prepared to stand up with those who are struggling against the aggression of the socialists in Australia, then they must not complain if they find that later they have made a rod for their own backs. The position at the Barrier is one full of interest and it can be said that although the 'outside' directors seem to be complacent, the majority of the people inside the country are not quite of the same mood.

Northern Territory. — The course of mining in Australia is still most uneventful. In the old days of mining excitement, discoveries followed one another so quickly that there was always some fresh attraction to sustain the interest of the miner and of the investor. But nowadays it seems as if the hope of finding a new mining centre had quite disappeared, so that it is the exception to hear of any fresh mineral find. However, it would appear that there is still some vitality left in the community, as the latest move is to try the recesses of the Northern Territory for oil. The suggestor in this case is one of those roaming Yankees that strike this Continent at intervals, and soon have some fascinating

story to tell of its undeveloped wealth that appeals immensely to the adventurous spirits found everywhere in our ranks. It is assumed that the area to be explored is away to the west of Port Darwin, the leading port of the country. In that direction lies an immense belt of unknown territory. An occasional white goes there. It seems as if the explorer to whom reference has been made is confident that he has found satisfactory indications of oil in the district. At all events capital is forthcoming to test the place. Perhaps the work that has been done in Timor has inspired the promoters of the venture to put up the capital needed. The Federal Government is willing to assist the miner in the Northern Territory at almost any cost, because it knows from the experience of the older States the importance of mineral discoveries in stimulating settlement and in promoting the flow of capital into a new country. The Administrator (Professor Gilruth) has already promised grants to one or two prospecting concerns that are doing their best to develop properties in different parts of the vast area included within the boundaries of the Northern Territory. At present a cloud hangs over the industry there because of the disastrous failure of the different British companies that have tried their luck in that part of the world, and because of the same ill-luck having befallen most of the mining ventures brought to us in the South. It may be added that another story as to the existence of oil comes from Papua. A great deal more evidence is needed to satisfy the doubting that anything definite is in the air.

Mount Elliott. — The shutting-down of the Mount Elliott came as a shock to the market, though the news did not at all surprise people on this side of the world, for they have had the experience of Mount Lyell so recently before them that they from the first expected that it would not be found to be the simple matter for the company to subdue the fire at the Hampden South Consols as was at first supposed would be the case by some of the company's officials. What was brought home also was the dependence of the Mount Elliott mine on the Hampden South Consols for its supplies of sulphide ore. To date the company has not been successful, like the Hampden company, in securing a second claim such as the Duchess to help it along. Until it does or finds a shoot of ore at the bottom level of its own mine, it will not have an assured future. In this connection it may be said that the plight of the Mount Elliott mine has

given rise to the rumour that that company may try to acquire the Mount Cuthbert mine to the northwest of Cloncurry, but it is not at all likely that any move in that direction will be successful, as the directors of the Cuthbert, having got a grand property, do not wish any other hands to control it except their own.

Gold Gravel in Victoria.—An official statement has been issued that an alluvial mine in northwest Victoria known as Cocks Pioneer is to be taken in hand by Lionel Robinson, Clark & Co., of London, on whose behalf the mine was examined by A. H. P. Moline, one of the most skilful of the younger

SAN FRANCISCO.

Petroleum companies operating in California and in Mexico report good earnings despite the political disturbance in the southern republic. The total of March dividends from California-listed companies was \$1,693,340; the Mexican Petroleum added \$240,000, the quarterly dividend on the preferred stock, and \$320,000 payment on the common. In the grand total is included \$1,250,000, the quarterly dividend of the Standard Oil Co., of California. These figures perhaps sufficiently indicate the prosperous condition of the oil operators.



generation of mining engineers. The claim is an extensive one, and the name of the district—Eldorado—tells of what it was in the old shallow alluvial days. The present company has held the claim for 8 or 10 years, and has mined on a small scale with a single dredge unfitted to deal with the wash on the scale that its extent needed. The new company will provide much more powerful plant and will therefore be able to treat the ground rapidly. So far the old dredge has been operating mainly on the drifts worked previously by the digger, and out of that it has won £120,000 of gold. Now the new company will tackle the virgin wash. This is about 90 ft. deep in the face and carries three floors; one at about 25 ft., another at 70 ft., and the third at 90 ft. There was not the least reason why the company should not have got the money it wanted for plant here without going to London. But capital here was too tight for that to be done.

The General Petroleum Co. distributed its first annual report this month. It will be remembered that this concern was organized within the year by Eugene De Sabla and his associates, and that in addition to owning important pipe-lines and wells, it holds an option on the controlling stock of the Union Oil Co. Returns during the past year were almost exclusively from sales of oil in the field only. Now with an 8-in. pipe-line completed from North Midway to Los Angeles, a distance of 158 miles, and with a branch under construction from Lebec to Mojave, the company secures a wider outlet for its product. In connection with the pipe-line, the company is building two refineries on the Trumble system, one at Vernon near Los Angeles and one at Mojave, each with a capacity of 20,000 bbl. daily. These and the line are expected to pay a good return on the investment. During the year four modern steamers, each of 10,000

tons (approximately 65,000 bbl.) capacity, have been chartered and tentative arrangements have been made for the construction of six similar vessels, as the business of the company warrants. Another important event in the foreign trade has been the appointment of the firm which is headed by Andrew Weir, a director in General Petroleum, as agents for the company in European countries. Water frontage to the extent of 1,200 ft. has been secured in Tampico with an average depth of water of 40 ft. The holdings of the Continental Mexican Petroleum Co., consisting of 5,500 acres, have been secured. This property is in the same district as and adjacent to the Juan Casiano well. The chief features of the year's work are summarized as follows: Increased its daily production from 3,500 to 9,500 bbl.; purchased petroleum to the extent of 10,000 bbl. per day; purchased from Atchison, Topeka & Santa Fe railroad all that company's high-gravity oil, and contracted with the road to furnish all fuel requirements for a period of three years; constructed an 8-in. pipe line from North Midway through Maricopa and Tejon to Los Angeles, and steel tanks with a capacity of 2,000,000 bbl.; appointed European agents and chartered four modern tank steamers; acquired 13,000 acres of land in California and 5,500 in Mexico. The total land holdings of the corporation in this state are now 23,000 acres, and in Mexico 24,500 acres.

The California Petroleum Corporation in its first published report reflects an equally cheerful situation. This company and its subsidiaries control the California properties developed by E. L. Doheney, president of the Corporation. The report is for the year that ended on December 31 last. The figures follow: earnings before depreciation, \$527,846; preferred dividend, \$217,192; balance, \$310,654; common dividend, \$184,384; surplus, \$126,299; available surplus of subsidiary companies, \$2,973,585; capital surplus, \$782,769; total surplus, \$3,882,627. The balance sheet, as of December 31 last, follows: Assets—Property account, \$33,066,166; investments of cost, \$122,336; oil inventories, \$488,595; other inventories, \$404,094; bills and accounts receivable, \$197,401; cash, \$493,274; deferred charges, \$9199; total assets, \$34,881,064. Liabilities—Preferred stock, \$12,436,514; common stock, \$14,823,070; capital stock sub-companies at par, \$1,002,000; bonded debt, \$2,276,200; deferred payments on land contracts, \$236,000; accounts payable, \$170,046; accrued interest, \$45,607; profit and loss surplus, \$3,882,627.

The report states that from the properties now owned and controlled by the Corporation there has been produced over 18,000,000 bbl. of oil and in 1912 the gross production amounted to approximately 5,600,000 bbl., or at the rate of 15,300 bbl. per day. Mr. Doheney says there has been erected upon one of the properties in the Midway district a plant capable of 'topping' 5000 bbl. per day. The process separates the gasoline and engine distillate from the crude oil, leaving the residuum to be sold at crude-oil prices and the lighter products at a much higher price, thereby increasing sales price per barrel considerably. The present plant is proving so highly satisfactory that more units are now being added to the plant in order to increase its capacity, and as soon as completed there should be distributed additional net earnings of \$30,000 to \$40,000 per month.

Net earnings of the subsidiary companies for the year that ended on December 31, 1912, before providing for depreciation, amounted to \$1,976,868. In addition to these earnings the California Petroleum Corporation, owning approximately 97% of the subsidiary company stocks, receives interest on \$1,326,000 of the bonds of subsidiary companies which it owns and interest on moneys advanced to them. Mr. Doheney estimates earnings for 1913 in excess of \$2,400,000. In conclusion he says: "The present outlook for the California oil business is most encouraging, due to the tremendous increase in the consumption of the lighter products, such as gasoline and engine distillate, and the expanding market for fuel oil, because of its more general use and promise of still greater use after the completion of the Panama canal. The future certainly promises higher prices and better market conditions generally."

The Mexican Petroleum Co., Ltd., the Mexican Petroleum Co. of California, and the Huasteca Petroleum Co., also Doheney concerns, report for the year ended on December 31, 1912, combined profits of \$2,849,771; deductions, \$4363; balance, \$2,845,407; preferred dividends, \$959,882; balance for common dividend, \$1,885,424; common dividends, \$960,000; surplus, \$925,424. The consolidated balance sheet as of December 31 last shows: Assets—Oil lands and leases, wells, and other properties, \$51,464,439; cash in hands of trustees under mortgages, \$85,328; current assets, \$3,899,942; Mexican Government dues paid under protest, \$155,178; deferred charges to profit and loss, \$12,925; total, \$55,617,814. Liabilities—Capital stock,

common, Mexican Petroleum Co., Ltd., \$32,000,000; preferred, \$12,000,000; Mexican Petroleum Co. of California, capital stock, \$87,689; Huasteca Petroleum Co., capital stock, \$2500; Mexican Petroleum Ltd. first lien and refunding sinking fund gold bonds of 1911, \$4,000,000; Mexican Petroleum Co. of California sinking fund 6% gold bonds of 1910, \$82,600; Huasteca Petroleum Co. and Mexican Petroleum Co., Ltd., joint 6% gold bonds, \$327,000; Huasteca Petroleum Co. coast pipe-line first-mortgage 6% gold bonds, \$889,600; current liabilities, \$2,935,626; reserve to depreciation, \$495,613; surplus, \$2,707,186; total, \$55,617,814. Since December 31 the Mexican Petroleum Co., Ltd., has acquired \$18,972 pipe-line participation certificates, with participation rights from June 30, 1912, issuing in exchange therefor \$4,268,700 common stock, and the profits have only been charged with accruals of certificates held by the public. Discount and expense on bonds sold have been charged to cost of properties.

Panama Pacific Exposition matters are beginning to take shape. On the grounds at Harbor View the service building is complete and in use. Dredging is nearly finished and docks are being built. The framework of the first of the exhibition palaces, a machinery hall, is being erected and other buildings are about to be undertaken. An immense amount of grading and planting has been done and much of the work which while important does not make much show, is out of the way. A director for the Department of Mines and Metallurgy has been chosen in the person of Charles E. Van Barneveld, recently professor of mining in the University of Minnesota. As Mr. Van Barneveld is a native of Holland, a graduate of McGill University in Canada, and has had a professional practice in Mexico as well as the United States, there is every assurance that the department will be organized and conducted along broad lines. The classification adopted provides for five groups of exhibits: (1) Working of mines, ore-beds, and stone quarries; (2) minerals, stones, and their utilization; (3) mine-maps, models, and photographs; (4) metallurgy; (5) literature of mining and metallurgy. These groups are subdivided into 58 classes, which will include displays relative to equipment and methods of geological surveys, mining bureaus, and other societies for the promotion of mining; to prospecting for mineral veins and deposits, petroleum, gas, and artesian waters; to assaying and sampling; to drilling and breaking rock,

sinking shafts, and opening galleries, drifts, and tunnels; to explosives and their use in mining; to the mining of coal and other minerals; to the use of motors in mine operation; to underground handling and transportation of ore; to machinery and appliances for drainage; to methods of ventilation; to methods of lighting; to mine safety, including signals; telephones, preventives of explosions and other accidents; to rescue work; to handling and weighing mine products above ground. These are but a few of the classes in the first group; the others will be divided just as comprehensively. The time is none too long, but it is expected that an excellent exhibit will be arranged, although the extent of foreign participation is still doubtful.

Restrictive Legislation.—The State legislature at Sacramento seems determined to pass some form of bill regarding alien ownership of land. In the form proposed the bill would seriously affect the rights of all aliens and would force the sale of any land owned by a corporation in which the majority of stock was held abroad. It is hoped that no such drastic law may be passed since in the effort to prevent establishment of Oriental farming communities a severe blow would be struck at all mining and land enterprises that use foreign capital—English owned mining companies among the rest. It is not to be anticipated that in the event of the passage of any such law the foreigners will spend much money exhibiting at the Exposition and in any event an Oriental boycott of California trade seems certain. If this matter can be satisfactorily adjusted in time, a wide participation in the Exposition is expected.

Engineering Congress.—Engineers will be interested in the plans for the Panama Pacific International Engineering Congress which is to assemble in San Francisco in August 1915. The Congress has been underwritten by the five national societies, the American Society of Civil Engineers, the American Society of Mechanical Engineers, American Institute of Mining Engineers, American Institute of Electrical Engineers, and the American Society of Naval Architects and Marine Engineers. A fund of nearly \$40,000 has been provided, the Exposition company will furnish an auditorium, and further funds for local entertainment are to be raised. Control of the Congress is in the hands of a Board of Managers including the presidents and secretaries of the societies mentioned, who together form the New York committee on foreign participation, and selected members of the socie-

ties resident in San Francisco, forming the Executive and local committees. It is planned to invite preparation of a series of papers which collectively shall afford a picture of the state of the engineering art in 1915. These are to be printed in ten or more volumes as a permanent record. Membership in the Congress will be voluntary but places on the programme will be by invitation. Since the Exposition itself is to celebrate the completion of the Panama canal, a number of general sessions will be devoted to the engineering phases of that great project and it is rumoured that Colonel G. W. Goethals will be invited to become honorary president.

Alaska Gold Mines continue to get much public notice, as, in fact, the big things that this company is undertaking, deserve. A recent statement made public shows that excellent results have been accomplished by B. L. Thane in the seven months since he took hold as general manager for the new concern. According to this statement the work is in three divisions: the 'Sheep Creek,' where a large adit is being driven, that will form the main extraction way, and where, at the terminus of the line, the mill will be built; the 'Perseverance' division, consisting of the Alexander cross-cut and the old stopes and where most of the actual development of the mine will be carried on; and the 'Salmon Creek' or power division. At Sheep Creek there were no dock or landing facilities and only two old concentrator-houses and camp-buildings with an old broken-down railroad connecting to the mouth of the adit. In this division there has been completed a wharf, warehouse, surface tramway from beach to mill, 2600 ft. long. The old railroad has been repaired and laid with new rails; a temporary boarding-house for 60 men has been built at the beach and a permanent boarding-house for 60 men at the portal of the Sheep Creek adit; also a temporary boarding-house at the mill for 40 men and three employees' cottages; compressed air, ventilating, and heating plants have also been built. The Sheep Creek adit has been repaired and widened for a distance of 1200 ft. and 600 ft. of new 8 by 10 adit driven, new ties and 50 lb. rails laid, water system installed, and the whole put in successful operation. At the Perseverance division the wagon-road from Juneau to the mine was in such a condition that no transport could be accomplished over it. There was an old compressor-plant but with power available only from May to October. The underground development consisted of the Alexander cross-cut, 2300 ft. long, tapping the vein, drifts 1800 ft.

in length and one vertical rise from the end of the cross-cut to the surface. The wagon-road has been completely re-built throughout, 8000 ft. of it consisting of trestle-work along the side of the precipice; a granite-back flume and a new pipe-line 1600 ft. long has been built, and a new 8-in. surface line 3000 ft. long to supply water for camp purposes; new compressor and minor buildings are completed. In the mine the old vertical rise has been enlarged and re-timbered for a height of 257 ft.; a vertical shaft is being sunk directly beneath this and will extend to the Sheep Creek level. This is down 44 ft. The incline ore-way has been driven 123 ft., the main east drift is continued along the vein for 455 ft.; the lower drift was also widened and timbered for 680 ft.; all adits regraded, new tracks and ties laid, a total footage during the year of 4441 ft. During the same time 106,658 tons was broken in the stopes, and 74,930 tons of ore treated in the old stamp-mill at an average cost of 78½ cents a ton. On the Power Creek division a tramway has been built from the beach to the upper dam-site; a main flume from the lower dam to penstock, 10,000 ft. long, and a pipe line from the beach power-house to penstock, 1600 ft. in length. The first unit of 2000 horse-power capacity has been installed and is in operation and 13½ miles of transmission lines have been built and connected with the other divisions. All of this work was completed in about six months, putting the company well ahead of its schedule. This, it is to be remembered, is the work of the Alaska Gold Mines Co., and must not be confused with the neighbouring Alaska Juneau at which F. W. Bradley and his associates are working, though in less spectacular fashion, to develop a property that competent observers anticipate will prove larger than the famous Alaska Treadwell.

TORONTO.

Porcupine.—A shortage of power resulting from a breakdown at the Waiwatin power-plant is interfering with operations at some of the mines, as the other electric plant at Sandy Falls is unable to furnish all the power required. It will probably require two months to repair the damage, and in the meantime production will be curtailed.

The annual report of the Hollinger mine, presented at the annual shareholders' meeting held on March 31, created a favourable impression, and the stock thereupon advanced to the record figure of \$19. The total operating profits for the year amounted to \$600,664, of

which \$270,000 was paid in dividends, and a balance of \$101,801 carried forward. The quantity of ore milled was 45,195 tons, from which \$933,681 was recovered, the average value of all ore treated being \$21.44 per ton. The position of the mine as regards ore reserves has been greatly strengthened. The tonnage is estimated at 644,540 tons, with an assay-value of \$11,271,400, the value a year ago being \$10,230,000. P. A. Robbins, the manager, states that there is an assurance of the persistence ore to a depth of 300 ft., and that there is no reason why it should not be found at greater depths; but in making the above estimate, no allowance has been made for ore that may occur beyond a depth of 50 ft. below the workings.

at the Jupiter. An ore-shoot about 420 ft. in length has been proved at the 300-ft. level, and rich ore encountered in a rise. A winze will be sunk to the 400-ft. level. It is hoped to have the mill in operation by the autumn. The Schumacher has cut two good veins showing visible gold, with the diamond-drill, at 400 and 800 ft. At the Porcupine Reserve the shaft is down 100 ft., and diamond-drilling will be undertaken to determine further development. The Swastika mill began operations toward the end of March, preliminary tests having proved satisfactory. Enough ore is being mined to keep the mill running. The Lucky Cross mill, the second in the Swastika district, has also been started and is reported to be treating from 40 to 50 tons of ore daily.



THE HOLLINGER MINE AND MILL.

At the McEnaney, one month's run of the small 5-stamp mill produced about \$20,000, being upwards of \$30 per ton on the average for the ore treated. The orebody has been proved for a distance of 500 ft., and the present value of the ore reserves is roughly estimated at \$875,000. The mill will be enlarged to 20 stamps. The Dome Lake mill with 10 stamps has been completed after many delays due to the strike and the difficulty of getting the machinery to the mine. It will make the sixth mill to go into operation in the district. The Foley-O'Brien, which has been closed for a year, has been taken over on option for a total consideration of \$91,200, by C. L. Sherrill and associates, of Buffalo, who control a number of other Porcupine properties. These will be passed to the Homestake Mining & Finance Co., controlled by the Sherrill interests. Active development is in progress

A good deal of interest is being taken in the Kirkland Lake area, lying northeast of Swastika, where the Foster-Tough property, formerly the Reamsbottom, carries ore so rich that it is shipped direct to the smelter without previous treatment. About a thousand claims in this locality have been staked. The four Woodward claims have been sold on a working-option basis for \$60,000 to J. Walter Young, of Haileybury, representing English capitalists.

Cobalt.—The sixth annual report of La Rose Consolidated for 1912 shows a fall in production and diminished ore reserves. The output was 2,816,597 oz. of the value of \$1,603,969, as compared with 3,691,797 oz. valued at \$1,810,470 in 1911. The ore reserves were estimated at 2,796,650 oz. as compared with 4,250,861 oz. The combined surplus of the holding and operating companies

was \$1,578,592, after paying dividends to the amount of \$936,641. The cost of production was 25.93 c. per oz., an increase of 8.11 c., owing to the large amount of development work done and the lower silver content of the ore. The annual report of the Beaver for the year ended February 28 shows shipments of 689,921 oz. valued at \$109,211, as compared with 750,950 oz. of the value of \$386,785 for the previous year. The total receipts were \$419,670, and expenditure \$231,338. There was paid in dividends \$180,000, and \$172,511 was carried forward. The mill is crushing nearly 100 tons of ore per day, the total amount treated during the year being 17,842, producing 278,512 oz. of silver. Reserves underground have increased from 3000 to 9500 tons, and there are 20,000 tons on the dump, the whole estimated to contain 775,000 oz. No actual figures for the ore reserves were given. A discovery of high-grade ore was recently made at the 700-ft. level, the deepest point at which high-grade ore has been found in the district. The strike of miners which took place on March 26 was amicably settled, and the men resumed work after being out for eight days. The Cobalt Lake has declared a second dividend of 2½% with an additional bonus of ½%. Plans for the proposed drainage of the lake are rapidly being matured. There will be no channel cut or engineering work undertaken, but two large turbine pumps stationed in scows will pump the water into Farr Creek. The work is expected to occupy four or five months. The old Silver Bar mine, the forlorn hope of the Preston-East Dome company, figures on the list of shippers with a consignment of 40,000 tons of ore. The Aladdin Cobalt has leased the Nipissing reduction mill at the south end of Cobalt lake, which will be principally used for the treatment of milling ore from the Chambers-Ferland. Interests desirous of obtaining control of the Peterson Lake are offering individual shareholders 43 c. per share for their holdings on condition that a sufficient amount of stock can be obtained to give them a controlling interest. An action for foreclosure on a mortgage for \$21,000 has been brought against the Little Nipissing, and as the company has no funds the property will probably be shortly offered for sale. The Gould Consolidated has gone into liquidation. Work has been resumed on several properties that had been closed-down for some time, including the Silver Leaf, Belmont, and Twentieth Century. The Drummond is understood to have changed hands, having been purchased by parties represented

by David Fasken and James H. Miller for a sum in the neighbourhood of \$500,000. The Keeley mine in South Lorrain, an asset of the defunct Farmer's Bank, has been taken over on a working option by English capitalists represented by Dr. J. M. Bell. The Mann mine of Gowganda has shipped 20 tons of high-grade ore running about 3000 oz. to the ton. A large amount of development has been done on the 90-ft. level, from which a winze has been sunk to the 150-ft. level in good ore all the way. The Miller Lake-O'Brien, in the Gowganda district, has shipped another car-load of high-grade ore containing 25 tons averaging 3500 oz. to the ton.

Eight Hours for Miners. The bill providing for an eight-hour day for underground mine workers has been passed by the Ontario Legislature, despite the objections urged by the mine-owners. As previously noticed, Ontario has been considerably behindhand in legislation ameliorating the conditions of labour, and several remedial measures, including a Workmen's Compensation Bill introduced this session, had been either voted down or postponed, creating some dissatisfaction among the working class. The feeling that something had to be done to satisfy the labour vote and atone for previous failures is doubtless responsible for the action of the government in forcing through the eight-hours measure.

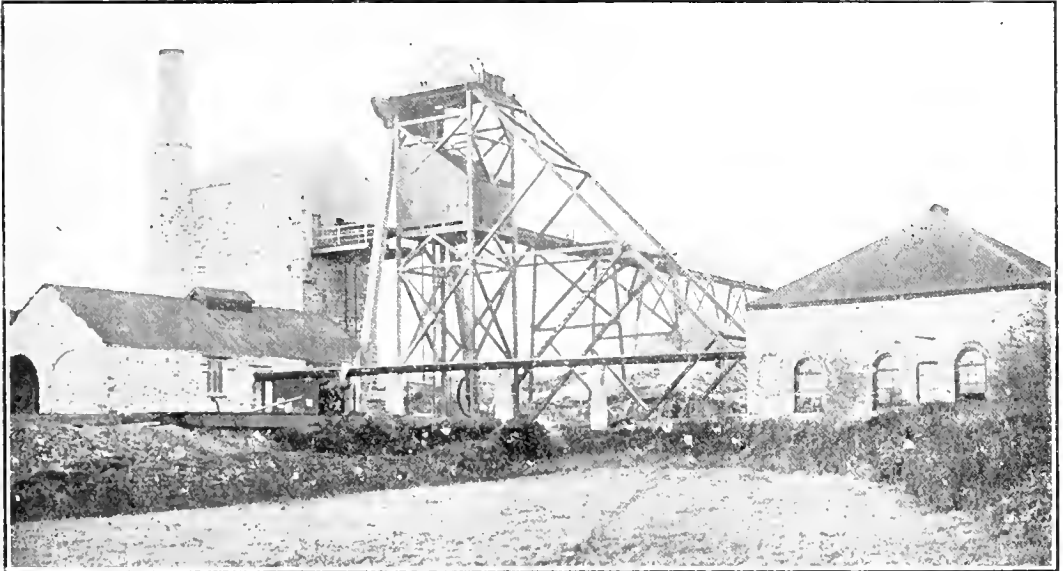
Lignite Coal as a Power Producer. The Government of Saskatchewan has undertaken an important investigation as to the commercial possibility of utilizing the extensive lignite coal resources of the province for the production of electric energy on a large scale to supply the demands of the southern section of the province. Experiments conducted last year by R. O. Wynne-Roberts, with the lignite deposits of the Sown's valley, showed that this coal is productive of a high percentage of gas per ton and a by-product in the shape of a briquet affording almost the same heating properties as anthracite. An experimental station has been erected at Estevan, where an elaborate series of tests will be conducted by Professor Darling, a distinguished American authority on the subject, to ascertain whether the use of lignite for the generation of power is commercially feasible. Should these experiments prove satisfactory, American capitalists are ready to supply the funds to install an immense power plant at or near Estevan for supplying power, heat and light to Southern Saskatchewan.

CAMBORNE

Wheal Kitty.—The returns at this St. Agnes mine are improving once more, but it is evident that for the current half-year there will again be no dividend, for although since the company left the tin-ticketing the value of the tin sales is not published, the quantities sold are given monthly, and these tell their own tale. The bottom level east on the Wheal Kitty lode has been exceedingly disappointing so far, while in the western end, the lode is thrown 30 fathoms, but the cross-cut to the other section is fast nearing completion. It is hoped that the content here will be more

lems. Two papers, showing much original research in connection with the treatment and recovery of tin ores, have been presented and discussed, and several more on the electrical equipment of mines and other interesting subjects are promised. These, and the discussion on them, will be subsequently printed and should prove valuable.

I hope in the near future to see this Society discuss other than technical matters concerning the well-being of Cornish mines, and now that the Chamber of Mines is defunct, the presentation of reliable statistics should come within its scope.



HEADGEAR AT SARA'S SHAFT, WHEAL KITTY.

in common with those found in this lode in the old workings, which made this property a handsome dividend-payer in the past. The best point in the mine at present is the end on the Stamps lode being driven west at 540 ft. level from Sara's shaft under the old West Pink mine; the lode is narrow but of high grade.

The new Cornish Society, called the Institute of Mining, Mechanical & Metallurgical Engineers, is proving a pronounced success. The annual subscription is only 10s. 6d., so the income is distinctly limited, but already, under the presidency of Josiah Paull, the capable manager of South Crofty, good progress has been made in fostering the chief object, which is the free discussion of Cornish mining, mechanical, and metallurgical prob-

Levant.—The last of the old cost-book companies continues to do fairly well, and although the important question of the renewal of the lease is still unsettled, the present shareholders seem to be in no way anxious to dispose of their holdings, at any rate at existing prices. For the sixteen weeks ended March 15, a profit of £1751 was earned, and a dividend of 7s. 6d. per share declared, absorbing £883, or about half the profit earned. The balance was added to the reserve fund, which now stands at £6,335, and is being built-up in readiness to meet the heavy expenditure on shaft-sinking and development, which it is anticipated the 'lords' will demand as a condition of a renewal of the lease. This is a sensible plan and will obviate the necessity for a heavy call on the shareholders, but it is quite

contrary to the old practice in cost-book companies. The want of a reserve fund was the cause of many mines closing in the past, for shareholders, who had come in at high prices, were loth to meet heavy calls to pay for neglected development or special expenditure which should have been carried out or provided while profits were good. For the 'account' referred to, 111½ tons of black tin was sold, realizing an average price of £136. 13s. 6d., and 2¾ tons of tin leavings which fetched £77. 15s. per ton. The tonnage stamped was 8899, so the tin recovery was 287 lb. per ton, but as sales of copper and arsenic were also made, the total value of the ore is not ascertainable. The total receipts were 37s. 2d. per ton milled, the expenditure at 33s. 3d., and the profit at 3s. 11d. This is a considerable fall from the 9s. per ton profit of the previous four months, but a lower price for tin of £3, a reduced tin recovery of nearly 5 lb. per ton, together with smaller credits for copper and arsenic, chiefly account for this. According to the manager, the developments in the bottom of the mine show a slight improvement, and this must be cheering to the shareholders, for the deepest levels have been poor for some time past.

Tin-Sands.—Various dredging propositions around the Cornish coast are meeting with opposition from those interested in the fisheries. A licence has been granted by the Duchy of Cornwall to a syndicate, in which Horton Bolitho is interested, to dredge portions of Falmouth harbour and the river Fal for tin, but the Truro city council is up in arms "in the interests of the oyster fishery, of navigation, and of the river generally." Again, prospective tin-dredging operations in St. Ives bay have alarmed the local fishermen, and already a public meeting has been held and a petition presented to the Government, urging the Board of Trade to withhold consent; and it seems unlikely, in view of the present state of the Cornish fishing industry, that anything which might injure it, even only to a small extent, will be permitted. Undoubtedly there must be large deposits of tin-bearing ground in the bay, but their profitable working seems a doubtful commercial proposition.

Carn Brea & Tincroft.—The stopes at this mine have apparently been decreasing in quality of late, for the sales are going back and the margin of net profit is getting dangerously fine. The sales of black tin for the first four months of the current half-year have, according to the ticketing papers, been 246½ tons, value £31,508, while for the same period

of the preceding six months, they amounted to 284 tons, valued at £35,001. Fortunately there has been a rise of £4. 10s. in the average price realized owing to the higher price of tin metal, which to a small extent off sets the fall in the sales. The vigorous development of this extensive piece of mineral ground will surely soon be rewarded by the discovery of better quality ore, and with a reduction foreshadowed in the costs by the erection of a new mill, there is no need to be despondent. The money to be advanced by Viscount Clifden—a sum not to exceed £25,000—for the new mill, will be secured by 5% debentures falling due for payment in ten equal annual instalments commencing on January 1, 1919. It is the intention to pay off the 16s. due to the priority shareholders out of the profits, and when this has been done, the priority shares will rank for all purposes as ordinary shares.

This is the only Cornish company which issues monthly details of its receipts and expenditure, and also gives the recovery made in pounds of tin metal per ton. The extraction for the month ended March 8 was 67'12% of the total tin content, so that it is clear there is ample scope for improvement.

Tresavean.—It is reported that recently a promising tin lode was discovered at the bottom of the Old East shaft on this old copper property near Redruth, which is being reopened for tin. The lode appears to be dipping south-south-east into entirely virgin ground. The erection of the powerful new cross-compound winding engine is well forward, and this will replace the electric hoists at present in use. The arrangements for supplying electric power from Hayle to the pumping installation are also nearly complete.

Marazion District.—A syndicate has recently been formed to promote a large company to work the Wheal Hampton, Owen Veal, Tregartha Downs, Wheal Rodney, Gwallon, and other mines in this district, which will give a continuous run of nearly two miles on the course of several lodes. It is proposed to operate on a scale second only to Dolcoath, so far as Cornwall is concerned. This district is a wet one and a large amount of money will be needed for pumping equipment.

Botallack.—It is unfortunate that the grade of ore milled shows no improvement. Indeed the average recovery for the sixteen weeks ended April 5 is slightly less than the 11 lb. average shown in the last annual report. The tonnage handled last month was 2350, the sales amounting to 12 tons 2 cwt., which produced £1620.

JOURNEYS IN NIGERIA

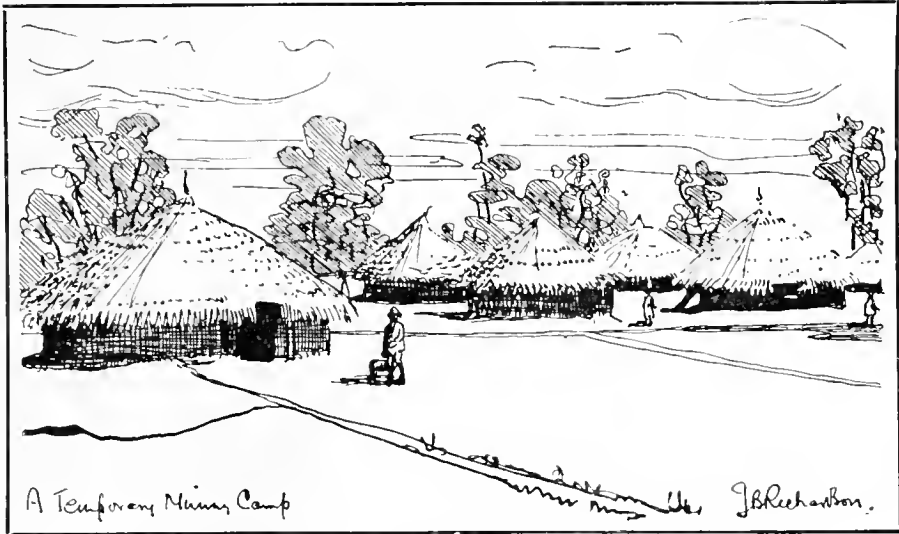
By J. B. RICHARDSON.

A mining engineer's experiences. The climate. The natives. The housing problem. Food supplies. Cooking. Servants. Control of labour.

THE life of a mining engineer in the Nigerian tinfields is by no means unpleasant. He escapes many of the hardships under which engineers work in regions far less remote from civilization; on account of the recent occupation of the country by the British, he has to keep up the prestige of the white man in a land of blacks; for the handful of

12-hour day, from six in the morning to six at night, which on the average includes all the hours of daylight.

It is naturally not so enervating on the plateau as in the river and coast districts; the nights are always cool, allowing good sleep to be enjoyed at all seasons of the year, and making a wonderful difference to the health



A MINING CAMP.

white men, always excepting the 'mean whites,' who are the same all the world over, are looked upon as little princes, and have to try to live up to that royal state.

The native, who is a firm believer in ostentation and pomp, will be more willing to work for an engineer who goes about as though he were an elder brother to all the crowned heads of Europe, than a man who reduces his staff of servants to a minimum and lives in a small mean way. Hence the average mining man lives like a lord, possesses a large number of personal servants, keeps a good table open to all European visitors, and, if opportunity and permanence of abode allow, builds himself as fine a house as he can.

The climate is more bracing than other parts of West Africa, and most mining men work a

and working capacity of a European. At a certain time of the year, for a few weeks before and after Christmas, the nights are even cold, causing numbed fingers and necessitating an early breakfast in overcoats. Although the rain and the changes of season may bring a little sickness and fever, most men get only slight malarial attacks unless they are old sufferers. In fact, if every one of the mining community out there took ordinary care not to expose himself unduly to the sun, there would be very little sickness directly attributable to the climate, not forgetting, naturally, that they are there temporarily; for, slowly but surely, the climate, as in the tropics always, tells on a European's system, adapted for colder lands and a more temperate sun. That is to be expected, for the white man was

surely not meant to make a permanent residence in a black man's country.

During the months of December, January, and February the *harmattan*, a dust-laden wind with the appearance of a dense Scotch mist, dries up the countryside, and fills the air with fine sandy particles, which find their way everywhere and make the ears, nose, and finger-tips raw and cracked. Sometimes the sun is almost obscured all day, and on most days till eight in the morning and from four in the evening. This intensely dry season, with the fierce coppery sun in the middle of the day, turns the whole landscape brown and makes the pools and streams disappear with a startling rapidity.

Toward the middle of March the tall grasses, dry and brittle, are thickly covered with fine dust, so that it is suffocating to walk through the bush. A little later the bush fires come, and make the hills and valleys a wonderful spectacle, more especially at night, when the slopes of the distant rugged hills are illuminated with huge flares, or a dying fire, with rows of spots and dots of light, calling to mind some hillside town at night.

The bush fires involve only the grass, and therefore are not fierce or dangerous; in fact, many of them you can walk or ride through along a narrow path. They leave the blackened ground bare and clean, ready for the early rains to bring the new grass along. The first rains, after months of dusty dryness, are more than welcome, and seem to hiss as they meet the parched and cracked ground, from which soon arises the most awful stench of staleness. It is a remarkable fact that in the plateau country there is usually one sharp shower early in January, and there are one or two severe hailstorms, with hailstones the size of pigeons' eggs, at the commencement of the rains.

Taken in all, although the climate is as regular as clock-work, it is quite varied, and from October till early June dry and healthy, and, even in the wet season, an engineer in a settled camp, with a good roof over his head, need not worry about excessive sun or torrential rain, as he always has a refuge.

If he is starting out to find and prove claims he experiences, first, tent life, with all its discomforts. With the continually shifting camp, and having no fixed understanding with the local natives, he leads a wandering life, living on tinned food except for irregular supplies at native markets. Yet, for all that, the exercise that has to be taken makes it healthy. In two or three days his own labourers will build

from the bush close at hand a temporary camp of grass huts, which will serve for a month or two, while the neighbouring streams are being examined previous to taking out a mining lease. Among the labourers are sure to be one or two men who are skilled in making huts. Give them each a little gang of workmen and they will rapidly cut down and collect forked branches and drive them upright into the ground in the form of a circle, and on this they erect a rough scaffolding to build the conical roof of stout bamboos or thin straight branches, tied with green bark to the centre pole of the hut. On this roof they put a foot of green grass thatch and a similar thinner cover round the forked uprights. The roof is water-tight at first, but after a few days it will leak, when it is patched with green grass, and then remains water-tight for some considerable time. Boxes and trunks, raised on stones to protect them from the ants, with native mats on the beaten earth-floor, make an abode much cooler and more airy than a tent.

The building of a permanent camp, once a site has been chosen, is a task that in Nigeria will take only a short time, in the dry season, at any rate. In that hilly country it will not be difficult to choose a good situation on the breezy slope of a hill, near a good stream, and then arrange a meeting with the local *seraki*, with whom you make a contract to build so many houses of a certain design, and indicate the position of each, and arrange a price and time for the contract to be concluded.

When a local *seraki* undertakes a building contract there is no lack of pomp and circumstance in the way he commences the task. He comes in his very best robes, with his kinsmen and chief supporters similarly attired, accompanied by as big a band of tom-toms and wind instruments as he can muster, a horde of labourers bringing up the rear.

For a few days there is great energy and excitement, with the eternal beat of the tom-tom. Then a slack period intervenes, until the white man hints that he is anxious to occupy his new house, and then they renew their vigour and enthusiasm. If you are having anything pretentious built, the placing of the roof-tree, or any big timbers or frames, is a task occupying the energy of quite 50 men, and everyone else comes to see it done. The rope to haul the frames is tested and broken on the tug-of-war principle for quite a day, amid shrieks of delight from the *seraki* and his headman, who are not above hauling on

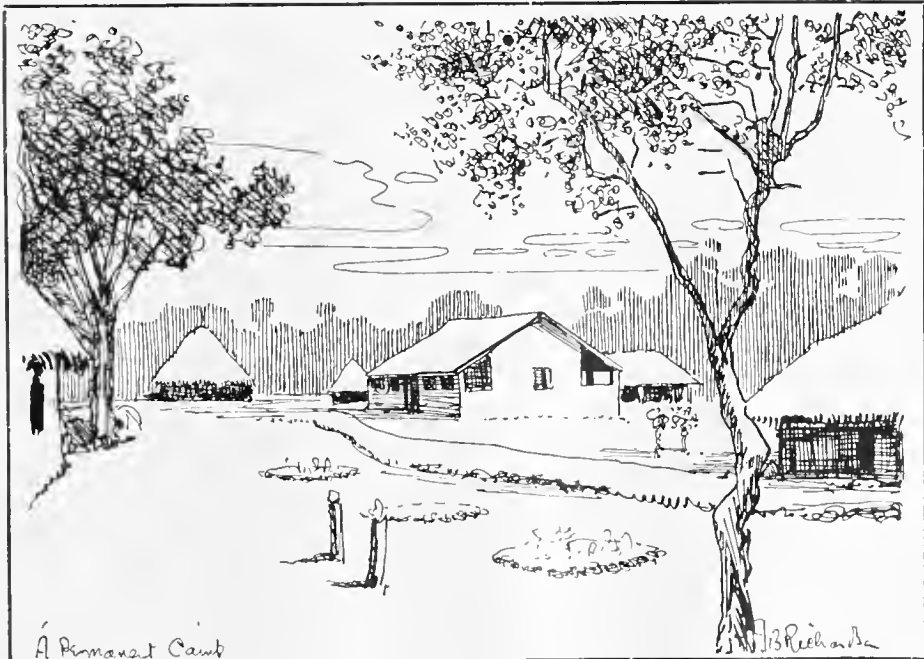


THE VILLAGE WALL.

the rope and entering into the game to the great loss of their dignity.

Every day the *seraki*, or his representative, comes to make his salutations, dressed in full robes, and every day he tells you how difficult it is for him to get enough men to do the big work, and how they are all grumbling at the small pay they are to get. But eventually the house is built, and he goes off quite satisfied with his contract money!

This sort of camp, provided you have time to attend to the building of it, to see that they are carrying out your ideas correctly, and you do not hurry and worry the builders too much, will prove cheap and comfortable, although it only consists of a collection of thatched mud huts. They can be built to form an airy bungalow, with a large clearing, on which the kitchens, stables, and offices are scattered, making a clean



A MINING SETTLEMENT.

orderly compound, all for a few pounds. Until the properties are proved and the value of the claims is known, this form of camp is quite sufficient, and when properly designed it compares well with mining camps built at ten or twenty times the cost.

Inside the mud bungalow, which may have several good sized rooms, the camp furniture from England and the rough tables and boxes made on the spot, with a good supply of native mats, beautifully woven with dyed grasses into variegated geometrical designs, and woven platters and baskets of finer grass, and pieces of cheap Manchester cotton prints from the local market, give an appearance of comfort, and make the loneliness of the life more tolerable.

Later on, when work is more advanced and the life of the mine can be estimated, it can be decided whether it is worth while to make and burn bricks, and set up carpenters' shops to make the doors and window-frames, and all the woodwork that is needed for proper brick bungalows and offices. Timber in the wooded valley on the edge of the plateau is plentiful, and, with a little care in choosing, quite suitable for building. There is a kind of mahogany that is hard and heavy and does not seem to be much attacked by white ants; and excellent bricks are made from the deposits of stiff clay which the decomposed granite yields.

The man who lives in a settled camp need not live on tinned food at all; all that he requires are necessities, such as flour, coffee, tea, sugar, and salt, and luxuries to make his living pleasant. He can make an arrangement with the nearest Fulani herdsman to supply him constantly with milk and butter, both of which are excellent as long as they are carefully cleaned, the milk boiled and strained and the butter washed several times with filtered water.

There is no lack of fresh meat: beef, mutton, and goat (against which Englishmen seem to have an unjustified prejudice) are easily obtainable: and, if the native method of slaughtering and cutting is objected to, it is easy and cheap to buy a whole beast or sheep and have the killing done in a clean manner under personal supervision.

Chickens abound. The smallest village will always be able to sell a few chickens, which are usually tough and measly, and as the natives do not eat eggs, they are always willing to sell them to the white man.

A whole beast is rather a large purchase for a one-man camp, but a goat or a sheep costs at most five or six shillings, unless perhaps in

Naraguta and Jos, and, with a healthy appetite, the usual scraggy animal will not last long enough to go bad.

Along most streams there are to be found bush partridge, guinea fowl, and green pigeon, all of which are better eating than the chicken, and as long as you only shoot for the pot they will not be scared away from the borders of the camp, especially if a little grain is occasionally spread in their usual feeding-ground.

At most seasons of the year it is easy to obtain good rice and a small grain called *utcha*, both of which are useful for puddings, and *utcha* makes quite a pleasant porridge substitute. Native spinach, large onions, yams, and many varieties of sweet potatoes, beans (rather like haricots) and ground nuts, with a variety of cucumber, are obtainable at certain seasons.

Tomatoes will grow like weeds, if the trouble is taken to plant them; and cabbages, lettuces, marrows, beans, peas, carrots, radishes, cucumbers have all been grown successfully with very little trouble. Fruit is not common, but paw-paws, which are somewhat like a melon but not so watery to taste, plantains, limes, and fresh and dried dates are sometimes in the market.

With regard to game, there is little round the tin region except birds and small buck, varieties of gazelle, that furnish good venison. There is also a rock coney, looking like a giant guinea-pig, which makes an excellent pie. Apart from that, many monkeys and occasional leopards are the only sporting shooting. Monkeys are much too human to shoot, although they are mischievous, and in isolated rocky camps liable to indulge in chicken-stealing, not to eat them, but just out of curiosity, to pluck and then to throw down. This is a gentle habit of the dog-faced baboon, which abounds in all the regions of bare granite hills in colonies two or three hundred strong.

In a settled camp, especially if there are several white men, in which case one is probably able to spend a little time in catering, there should be no lack of fresh food, which is far healthier than the eternal 'tin-chop,' and by a skilful combination of the two the food of any camp should be good and varied.

These conditions do not apply universally; at Naraguta and Jos, where there is rather a large European community, the supply falls far below the demand, and prices reach a height that makes it economical sometimes not to buy native produce, and on the plateau proper some of these things are not obtainable at all.



THE SERAKU'S VISIT.

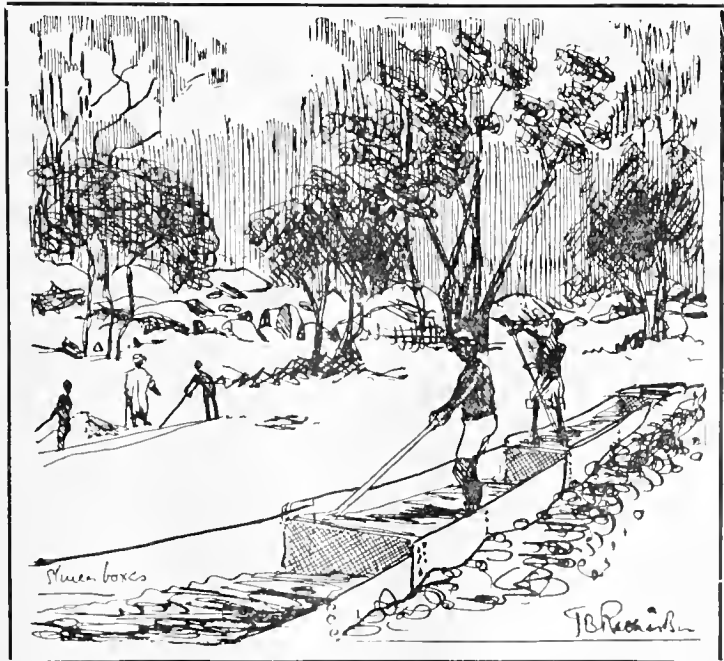
It is a good idea to keep a hennery if you ever want to get an eatable chicken and eggs of a good size, but this is inadvisable right among the hills, as bush cats play havoc with the poultry and the hawks decimate the young chicks anywhere.

The natural sequence to a good supply of food, tinned and fresh, is a good cook, for with bad cooking any man, especially in a tropical climate, will soon become internally disorganized. A good cook that is a good servant is as rare in Nigeria as in any country. The coast and river 'boys' who have been white men's servants in the big settlements down there do not like a bush life away from their own kind, and to find a Hausa or Fulani boy who is clean in his cooking is practically an impossibility. However, by taking your would-be cook in hand and telling him over and over again how to do his work,

teaching him, and exercising more patience than you have ever done before, you will make him by the time your tour of inspection is ended quite useful for some other white man. A good cook-boy will get anything from 30s. to £3 per month in wages, besides which there must be perquisites, and he probably does not spend much of his pay on food.

If his master is a 'tin-bature,' that is, a tin-mining engineer, he probably will not see him most of the day, so that a cook's life is an easy one. But even though they as a class have such an easy time and good pay, they, like so many domestics, will not have the sense to do their portion properly, and, from the Accra cooks, with their dainty little habit of putting powdered glass

in their masters' food when he has punished them, to the Hausa or Yoruba cook who gets drunk on your whisky, and then proceeds to



SLUICE-BOXES.

open up your cash-box with a hammer and chisel, all show the greatest leanings to villainy. It must be the mental state engendered by the heat of the kitchen and the sun.

Honest servants, of a sort, are plentiful; and, if kept up to the mark, efficient; unless they are gamblers, when they become thieves; or dirty, when they become dangerous from the point of view of skin-diseases. The younger they are, the more willing and intelligent they seem as a rule, and the less time they will want to spend in the village. A young river-boy who has been well-trained at Lokoja or some such big town by a white woman is a treasure. They do not like to work under European ladies, for the reason that they are kept always on the go. But it is delightful to have a servant who has been taught how to keep a room dusted and clean, and who can put back papers where they came from.

On the whole, the Asabas, Ejohs, and other lower Niger races make good servants out of their own country; Ejohs especially, because they are economical with the stores, not to say mean, and they are scrupulously clean, though quarrelsome and unable to stand long marches, as, living all their lives for generations among the mangrove swamps they are a soft-footed race and their feet become terribly cut up in the granite hills. They seem to have some personal regard for their masters, whereas the Hausa or Fulani servants look upon their master simply as something from which to extract as much as possible. For example, if you have made a bush-boy, a raw product of the country, your servant, and have trained him to his job, at Christmas, or on some big occasion, you take him into Nara-guta and fit him out with new white clothes, and make him generally clean and smart-looking. The next morning he is nowhere to be seen: he has gone off in all his glory to obtain a better-paid job on the strength of his new clothes and probably a stolen reference, and you are left stranded.

The one thing that all servants cannot resist stealing from you is soap, not particularly for personal use, but because they want it for their clothes or to sell or give away. As a rule, the servants, and, in fact, the native population generally, are temperate people, but the cowardly coast natives, semi-civilized, missionary-taught, and insolent to a degree, never miss a chance of filching your liquor, not particularly because they are drunkards, but, supposedly, because it looks big before the other black men to drink white man's drink, for the coast-boy is nothing more than

a monkey in his desire to imitate all the tricks and habits of the superior white.

Many white men, through laziness and mistaken kindness, treat their servants in a lackadaisical way, and allow them to have all their keys, even of the cash-box. They say they can trust Tom or Howdu implicitly, but a wakeful visitor, after all the camp has retired, will find Tom or Howdu making an excellent midnight supper from salmon and green peas and any of his master's stores that are handy! The man who treats his boys with what is known at home as kindness simply earns their disrespect and suffers wholesale robbery as a reward. How can the descendants of hundreds of generations of slaves, with all the vices and degradation of slavery, develop into rational thinking beings in two or three generations of freedom?

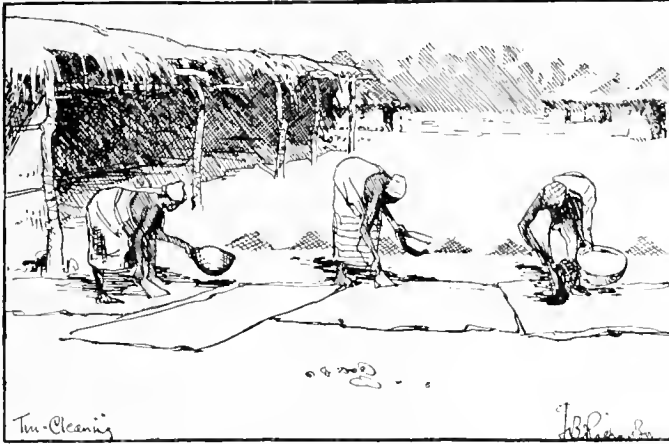
The servant problem is acute and important even in Nigeria, for a solitary white man with an establishment to maintain, where visitors often come, must give a little time and thought to his household and domestic worries, for his own sake and his friends. But the eternal bickerings and quarrelsome complaints of half a dozen black boys are liable to interfere with work unless a strong hand is employed to keep them well in their place.

The labourers and their village are another perpetual thorn in the flesh of the engineer. The natives of Nigeria are most primitive in their ideas of sanitation, and it is imperative to make and place an official in the labourers' village who is absolutely responsible for the cleanliness of it. Unfortunately, he is liable to abuse his authority, for the purpose of bettering his friends and injuring his enemies, but unless you employ such a person the camp will become in quite a few months unfit for habitation, and the only remedy then is to clear out the labourers and their women and belongings, set a match to the huts, and give them a day's leave and a new site to build the camp.

It is advantageous to have a labourer's settlement near a main road, from the point of view that when you want fresh labourers they are quickly obtainable; in fact, there will be some in camp on the look out for work. Moreover, men will prefer to work near a main road as there is more life and better markets. On the other hand, a roadside camp rapidly gathers a large colony of traders and wasters; cloth merchants, leather merchants, and professional gamblers set up house, and this gives rise to many debts between the labourers and the traders and among the workmen them-

selves. Then quarrels start, and you have to clear out the whole crowd of non-working members of the little community, much to the discontent of the honest traders and the more respectable workmen, who find it an advantage to have the traders on the spot.

common, but there are many who lose a lot of concentrate by careless washing, so that careful weeding is necessary. In working the simple jiggging machines employed and the regulation and working of the sluice-boxes, the natives are quite efficient, but need constant

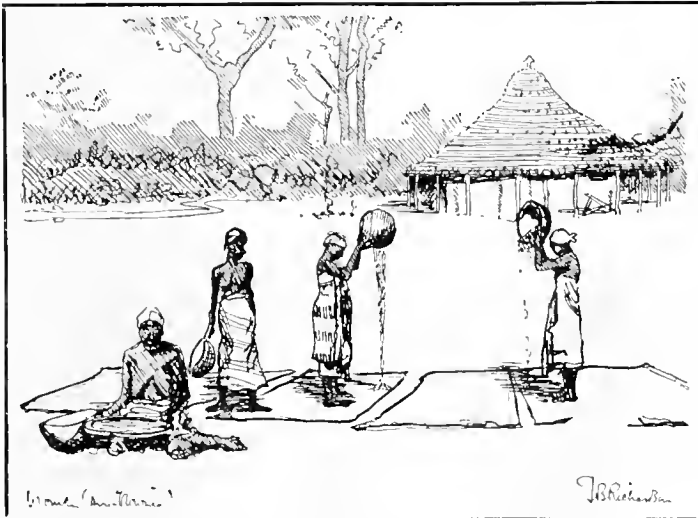


CLEANING TIN CONCENTRATE.

The labourer was, and still is, independent of the white employer. If they are fined or harshly treated, however much they may have deserved it, the headman after the next payday will gather his little following and migrate

surveillance to curb slackness and, therefore, loss of tin.

For dry-blowing the partly clean concentrate and improving the grade of the various portions that have heavy minerals included,



DRY-BLOWING THE TIN.

to some other camp where the white man is easier to deal with.

As regards intelligence, there are many workmen who rapidly become skilled in the various primitive methods employed in concentrating and cleaning the tin. Skilled calabashers are

women are often employed, working under long open sheds through which the breeze can blow, with woven sieves and trays of plaited grass. As the women always do the winnowing of the corn, they rapidly become quite expert in dry-blowing.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

April 1913	Mar. 1913	April 1912
£68. 4s. 10d.	£65. 8s. 9d.	£70. 8s. 0d.

The market during April has been uneventful, periods of active trade alternating with periods of depression, but without either buoyancy or panic. Operators, indeed, are restrained by political considerations, and while these continue to show uncertainty, so long will price-movements be insignificant. Trade is wonderfully good. Some observers think they can detect a falling-off, but as yet no signs of that are to be perceived in shipments or warehouse returns. Indeed the American figures for March show a record consumption, and we appear to be on the way toward a low reserve such as was witnessed last summer. The remarkable feature in face of the large shipments to Europe and the steady decrease in warehouse stocks is the persistent demand for spot supplies, which sellers find difficulty in satisfying. It is this demand that encourages the trade to expect a heavy buying movement as soon as ever the prospects of a settlement of the Balkan troubles is assured. Speculative activity at the moment is dead, but the prospects are favourable both statistically and economically for its revival.

Electrolytic copper is selling in America at 15 $\frac{3}{4}$ cents, and in Europe at £72 to £72. 10s. American deliveries are reported to be large, and the shipments to this side are on a huge scale.

SPELTER.

Average prices of good ordinary brands :

April 1913	Mar. 1913	April 1912
£25. 2s. 4d.	£24. 11s. 4d.	£25. 8s. 10d.

There has been more business doing in this metal recently, the apathy of consumers having at last been disturbed by the steadiness of prices. Demand for early delivery has been heavy and the London quotation shows 20s. rise. Inquiry for forward deliveries is still restricted. Galvanizers are busy, but prices are rather low.

TIN.

Average prices of cash standard tin :

April 1913	Mar. 1913	April 1912
£224. 14s. 2d.	£213 11s. 10d.	£200. 8s. 3d.

Prices on the whole have been well maintained during the month. Manipulation on the part of continental interests and the statistical position of the metal have been in favour

of higher prices. American parities have ruled well under the London market, yet shipments on a large scale have been made from English warehouses to New York, and operators are doubtless preparing to give the bears an uncomfortable time. Reports are received from time to time of the closing of Welsh mills, but consumption there continues steady, although manufacturers appear to be holding large stocks of unsold tinplates. Any fall is probably temporary; at any rate the demand for tinplates is continually growing in spite of many attempts to find a cheaper substitute. It is reported that the Standard Oil Company has given orders in South Wales for 250,000 boxes of tinplates, so that the loss of the Black Sea market may be compensated by a revival in the American demand.

The April statistics show a total quantity in sight of 10,814 tons, the smallest supply on record; this met the market anticipations and had no effect on prices.

LEAD.

Average prices of soft foreign lead :

April 1913	Mar. 1913	April 1912
£17. 8s. 10d.	£15. 19s. 8d.	£16. 6s. 6d.

The demand for this metal has been quite feverish, and prices show a remarkable buoyancy, while demand is everywhere good, and in the electrical trade enormous. Supplies are still curtailed from Mexico and also from Australia, where the labour unrest is again interfering with production. Shipments to the continent are unusually large. Consumers, in their persistence in running their works on insufficient stocks, are largely responsible for the fluctuations, as importers are unable to anticipate the requirements of their customers. A further rise in prices is foreshadowed in the depletion of stocks at producers' works.

OTHER METALS AND MINERALS.

Prices quoted on May 9 :

SILVER.—27 $\frac{3}{4}$ d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £90 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£32 to £35 per ton.

QUICKSILVER.—£7. 10s. per flask.

MANGANESE ORE.—10d. to 1s. per unit.

IRON ORE.—Cumberland hematite 27s. per ton at mine. Spanish 21s. 6d. delivered.

PIG IRON.—Cleveland 67s. 6d. per ton. Hematite 80s. per ton.

WOLFRAM ORE.—33s. per unit (1%).

CASSITERITE IN SOIL

Where weathering is more rapid than erosion, Cassiterite is found in the soil adjacent to the rocks of origin.

By GILMOUR E. BROWN.

BETWEEN the many and varied forms of primary tin deposits and the detrital deposits, grouped and described as 'alluvial,' embracing usually the idea of deposition from water in motion or under hindered-settling conditions, the intervening type or transition deposit is worthy of notice. The formation of such deposits is due to the mechanical movement of the cassiterite from the position from which it was deposited under temperature conditions varying from pegmatitic to hydrothermal, and its subsequent temporary retention, with or without concentration, in a mass of detritus derived from the parent or other rock. Generally there is no break in the cassiterite's journey from its original resting place to the lowest level possible, and in many instances in its descent it can be traced to the decomposed outcrop of a stanniferous mass or vein, or on the other hand, to a true alluvium, in which by virtue of its comparatively high specific gravity it has undergone considerable concentration.

The opportunities for concentration while water-borne are so superior to those prevailing in the previous stage of the journey that in many localities the alluvium is the only class of deposit that can be profitably worked and often exceeds what remains of the original deposit in economic value. Notwithstanding, cassiterite in soil is more often worked or capable of being profitably worked than is generally supposed, particularly in those countries where the zone of weathering extends to considerable depth and, although rarely extensive in any one locality, is not an unimportant source of the metal. Occasionally when cassiterite is discovered in soil it is studied, not with a view of ascertaining if it is present there in sufficient quantity to be workable, but as a means of tracing its source or of indicating the whereabouts of more extensive and probably more profitable alluvium at a lower level.

In the neighbourhood of every primary tin deposit there is some distribution of tin ore throughout the adjacent soil, but whether the amount is sufficient to merit attention depends

on many conditions, geological, physical, and climatic. These conditions are so interdependent that what may have proved to be a favourable combination of geological and physical conditions in one climate, might be found altogether unfavourable in another climate. Any concentration, too, of the cassiterite in the soil depends so largely on the relative rates of weathering and erosion that each case must

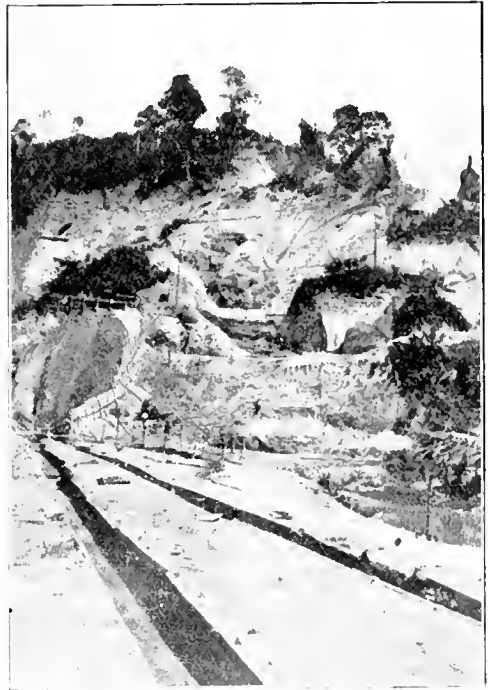


Fig. 1. Side of Hill worked by Ground-Slaying.

be studied apart. But generally it may be assumed that deductions from any one occurrence can be applied successfully to a similar occurrence in the same country or at least in the same district.

For the sake of comparison and of illustrating the various factors involved in any accumulation of cassiterite in soil, it is interesting to contrast the conditions favourable or un-

favourable to the formation of such deposits on the Bolivian plateau with those prevailing in the Malay peninsula, these two countries being the most important tin producers.

In Bolivia the great majority of the tin deposits take the form of veins in intrusive rocks high in silica, the veins extending at times into the intruded rocks. Other types of primary tin deposits are rare, and form a very small proportion of the whole. The Bolivian plateau has an average height of over 12,000 feet above sea level, and the mountains, in which the mines are situated, rise to considerably greater altitudes, reaching 20,000 feet, as at Quimsa and Tres Cruces, and often form isolated groups rising abruptly from the plains.

Owing to the latitude being only 16 to 21 S. and also to the high altitude, the daily range of temperature is great, and the rocks, owing to the scarcity or absence of vegetation, receive the full effect of the changes. A few days after a fall of snow, all the mountain slopes in one direction may be quite devoid of snow, while on the opposite slopes not a piece of rock can be seen, and the streams sheltered from the sun form miniature glaciers. The occasional heavy rains, falls of snow, and high winds in August are all factors in the great rate of erosion, which on northern slopes in particular exceeds the rate of weathering, veins showing sulphides being found at or almost at the surface.

Owing to the rapid erosion, the material is hurried from these slopes, so that little concentration is possible until the flat land at the foot of the mountain is reached, the cassiterite taking part there in the formation of alluvium. On moderately steep southern slopes the probability of an accumulation of soil is greater, and on these slopes, and even on some northern slopes where the veins are favourably situated, soil (*llamos* of the Bolivian miner) is occasionally worked and would be more so if it were not for the difficulty of conveying the soil to water or vice versa.

In that country the most favourable condition for concentration of cassiterite in the soil exists in the case of a vein striking down a slope which is only moderately steep. When a vein strikes at right angles to the slope or broadside on, the eroded mineral is carried away from the line of vein, and only the subsoil adjacent to the decomposed outcrop of the vein may be worthy of attention. On the other hand, with a payable vein favourably situated with regard to the slope, it is possible to secure profitable material over a width many times that of the vein beneath before

the workings narrow in depth into open-cut workings on the vein proper. In one instance I found it possible to remove a width of 12 ft. for a depth of 10 ft. from a small vein 4 in. in width, averaging 30% cassiterite, without the content falling below 2%, which shows a concentration of over 2 to 1. Narrow veins of such high tenour are not uncommon in Bolivia.

Turning now to a consideration of the conditions prevailing throughout the Malay peninsula, it will be found that there, as in many tropical countries, the rate of weathering far exceeds that of cold or temperate regions and is the determining factor in the formation of workable soil deposits. The primary tin deposits of Malaya, that have up to the present been exploited, are by no means numerous and bear a small proportion to the alluvial deposits, or those so-called alluvial deposits, which have been proved by the Government Geologist, J. B. Scrivenor, to be of glacial origin. The scarcity is more than equalled by the variety, and of the various types the stock-work is perhaps the most common, although that in which the cassiterite is either a primary constituent of the granite or finely disseminated through a mass of granite is also of frequent occurrence, particularly, as far as my experience goes, in the less known State of Johore, to the south of the peninsula.

Primary deposits are also found in the intruded sedimentary rocks which together with the granite constitute the ranges forming the backbone of the country. The slopes of these ranges are steep to slight, and in their primitive state are thickly clad with vegetation, which tends to bind the soil and hinder creep. The rainfall is good and seasonal heavy rains accelerate the rate of erosion which, however, fails to keep pace with that of weathering, 30 ft. or more of soil and subsoil being frequently observed. On very gentle slopes there is a decided tendency to form laterite, which implies a consolidation of the soil particles, checking entirely the downward movement and concentration of the cassiterite. In one locality I found a payable capping of loose soil, derived from adjacent slight elevations, resting on an unpayable stratum of soil partly laterized.

On moderately steep slopes the disintegration of the granite is complete, and, if no quartz veins or segregations are present in the parent rock, it may be possible to sink over 20 ft. without encountering rock fragments greater than a pea, these representing the original quartz of the granite. When the soil



Fig. 2.—TWO-INCH MONITOR AT WORK. (Note depth of soil).



Fig. 3.—OPEN-CUT ON 4-ft. VEIN

assumes in depth the colour of the granite and friable disintegrated fragments of the latter become numerous, the limit of payable detritus has probably been reached, and such material should in every case be sampled separately, with a view to its profitable inclusion with the overlying detritus.

Uniformity in the distribution of the tin mineral, not in depth but laterally, is largely dependent on the type of primary deposit, the greatest variation being found in the vein type with rich veins of moderate width.

So close is the relationship between the rich spots and the underlying veins that the former have been used, where veins are known to occur, in indicating the direction in which search should be made for the veins. The direction of the vein with regard to the slope plays an important part in the soil-enrichment. The miner in Malaya, unlike the Bolivian miner, prefers the veins to strike at right angles to the slope to ensure a greater and more thorough distribution of the cassiterite.

An actual example from a large mine, exploiting veins, soil, and alluvium in one of the states under the Federation, will serve to illustrate this point, and show the importance of maintaining a bright look-out for soil deposits. An area of 4 acres, having soil 25 ft. deep, measured at right angles to the plane of the slope which averaged 26° , situated on the rounded end of a hill (See Fig. 1) rising 270 ft. above the small river at its immediate base, yielded over 180 tons of high-grade tin concentrate, the amount of concentrate per cubic yard removed being between 1.7 and 1.9 lb., sufficient to leave a handsome profit even on indifferent methods of working. The removal of the soil by ground-slucing and hydraulicking (See Fig. 2) exposed 11 small lenticular ore-bodies averaging under 80 ft. in length, under 5 in. in width, and containing 3% cassiterite. The vanning assay failed to show tin in the granite itself, and there is every reason to believe that the tin mineral recovered was derived from the veins exposed, although a little may have had its origin in a relatively few mineralized cracks in the granite.

The strike of the veins across the rounded face of the hill, the river at the base, steep gullies on two sides of the hill, all implied unusually rapid erosion, and it was evident, on a little reflection, that the results obtained from this area could not be applied to other parts of the same property where tin-bearing veins were equally abundant.

The cassiterite was not found regularly distributed as regards depth, but was concen-

trated in the lower portion of subsoil, the upper stratum rarely showing an amount exceeding 0.1 lb. per cubic yard, and all capable of passing through a screen having 60 holes to the linear inch. In advance of the area worked there was a quartz vein, 5 ft. in width, carrying 2% cassiterite, striking down a slope of 30°. The richer soil above the vein had been removed in an open cut (See Fig. 3), but round the sides of the cut the soil showed an average content of 1 lb. cassiterite per cubic yard, while away from the line of vein no higher value than 0.25 lb. could be obtained. These results were greatly exceeded by a 20-m. vein, carrying 1% cassiterite, broadside on to a steep slope in a narrow gully, the soil below the vein down to the level of the gully yielding 3.6 lb. of concentrate per cubic yard.

The hill soil on this property was recently tested by a firm of mining engineers experienced in the conditions of the country, the method being to lay out the ground in squares of 250 to 300 ft. sides and sink pits or bores at the corners, irrespective as to whether the underlying rock was tin-veined granite, schist, or later non-stanniferous porphyritic granite, both of the latter occupying large areas of the property. Many old 3-ft. Chinese shafts, scattered over the surface as if from a pepper box, were also sampled. They estimated a profit of £141,000 from 130 acres of hill soil, and it was a noteworthy feature of their report, illustrating admirably the local nature of the rich patches and the difficulty of arriving at an estimate, that in the larger and poorer block of 110 acres not 80% of their equidistant pits or bores gave samples equal to the average (0.8 lb. per cubic yard) assigned to the block.

In districts of gentle slopes and slight relief, the conditions are not so suitable for a concentration of the cassiterite, the lack of sufficient gradient to remove the lighter soil and allow rapid erosion of the stanniferous body being the chief detrimental influence. Usually there are no workings in the granite or other rock, and the distribution of cassiterite throughout the detritus often implies an even and poor dissemination in the granite or parent rock. Workings in such districts are well down on the slopes of the low hills immediately before the change to flat land, generally of a swampy nature. The soil as a rule is poor in cassiterite, but patches of a few acres containing no more than 0.5 lb. per cubic yard for depths varying from 3 to 13 ft. are profitably worked by the Chinese. The easy gradients facilitate bringing water to the work-

ing places, and a few Chinese coolies, engaged in ground-slucing, are well rewarded with 2 lb. of concentrate per day.

When cassiterite is found on these slopes, the swampy hollows will usually be of sufficient richness to work, even by Chinese methods, which involve maintaining the workings free from water. Particular attention should be paid to the head of the swamp, where there is generally a tiny stream which could have borne little part in the transportation of cassiterite particles when slopes were steeper. Even when the transporting power of the stream is slight, there is some arrangement of the soil particles, at least according to volume, and a tendency to the formation of layers with grains of equal size is noticeable, so that these deposits may be ranked as intermediate between soil and alluvial deposits. The chief characteristic of these deposits is the lack of any relation between the volume of the grains of cassiterite and the enclosing grains, the former occasionally exceeding the latter in that respect.

Lower down the valley, the payable material is often covered with fine transported material, poor in cassiterite, which has to be removed to lay bare the payable stratum, increasing the cost of operations and necessitating a higher grade for the latter. The bottom layer in the valley frequently contains large angular pieces of quartz, with an occasional rounded pebble, and the greater portion of the cassiterite.

As an example of the value of this class of deposit, one mine in the south of Johore preparing for pump-dredging has proved 16 acres, of theoretically the best part of the hollow, to contain a workable average of 1 1/2 lb. cassiterite per cubic yard for a total average depth of 25 ft. The cassiterite varied from nothing to 21 lb. per cubic yard and was mostly in the lower portion.

With the present high price of tin, such deposits as those described are in active exploration in the State of Johore, and no doubt similar deposits, perhaps unworked, occur in other countries with a tropical climate.

A sluicing plant carried on a rail-track is being used near Dillon, Colorado, for treating a gold placer. The material is lifted by steam-shovel and carried by a belt-conveyor to the washing plant. The latter is mounted on quadruple swivel trucks. The gold is caught in ordinary sluice-boxes, and the general routine is similar to that of an ordinary floating dredge.

Canadian Mineral Production.

The preliminary estimate of the mineral production of the Dominion of Canada during 1912, prepared by John McLeish for the Department of Mines, shows an increase in value over 1911 of \$29,906,495, the total figure being \$133,127,489. The details are given in the following table :

	Quantity	Value
		\$
Copper.....Lb	77,775,600	12,709,311
Gold.....Oz	607,609	12,559,443
Pig iron.....*Tons	1,014,587	14,550,999
Lead.....Lb	35,763,476	1,597,554
Nickel.....	44,841,542	13,452,463
Silver.....Oz	31,931,710	19,425,656
Other metal products.....	—	982,676
Total		75,278,102
Less pig iron credited to im- port ores	978,232	14,100,113
Total metallic		61,177,989
Asbestos and asbestic...*Tons	131,260	2,979,384
Coal.....	14,699,953	36,349,299
Gypsum.....	576,498	1,320,883
Natural gas.....	—	2,311,126
Petroleum.....Bbl	243,336	345,050
Salt.....*Tons	95,053	459,582
Cement.....Bbl	7,120,787	9,083,216
Clay products.....	—	9,343,321
Lime.....Bushels	7,992,234	1,717,771
Stone.....	—	4,675,851
Miscellaneous non-metallic...	—	3,364,017
Total non-metallic.....		71,949,500
Grand total.....		133,127,489

* Short tons throughout.

The most notable new producing district during the year was Porcupine, from which gold worth about a million and three-quarter dollars was extracted. Another item of note is the increase of the ore reserves in the nickel-copper district of Sudbury, due largely to developments by the Dominion Nickel Co., and in some of the copper and lead deposits of British Columbia, the fact pointing to an increase in the output during the next year or two. The outputs of gold, copper, lead, nickel, and coal show substantial increases, silver remains about stationary, and pig iron shows a slight advance. The production of petroleum continues to decrease, and not 5% of the Canadian consumption comes from home resources. On the other hand, the production of natural gas has been increasing. This mostly comes from Southern Ontario, but New Brunswick and Alberta are also coming forward.

RESULTS FROM SAMPLING

The Analysis of the various Samplings of a Mine in Nicaragua.

By C. S. HERZIG.

A GREAT deal is written from time to time about variations in the results obtained in mine sampling. The tabulated statement on the opposite page shows a remarkable similarity of results obtained, under widely varying conditions, in the examination of the Leonesa mine, in Nicaragua, by five different engineers over a period of nearly nine years. During the whole of this time, active development work was in progress. For obvious reasons, I have omitted the names of the persons responsible for the different estimates, except the last one, for which I am responsible.

It will be seen that the earliest estimate shows the largest amount of profit. The remarkable thing in connection with this tabulation is the great similarity of the average value assigned to the ore. Aside from the examination made in 1900, and marked 'A,' where the average value of the Leonesa ore-shoot is given at \$11.48, the average assay-value of the Leonesa ore, as determined by the other four examinations, varies only between \$9.20 and \$9.98. In other words, there is a maximum difference of only about 10% in the average assay-value, a remarkably close result in any type of deposit. When it is considered, however, that the Leonesa orebody is one of the most difficult to sample within my experience, it will be realized that the close checking of the assays is noteworthy.

The Leonesa orebody is a deposit of the replacement type. The ore is thoroughly oxidized and consists of quartz, altered country-rock, manganese oxide, and ferruginous clay. The valuable minerals are gold and silver. Tests made by me to ascertain the distribution of the richest components of the ore failed to give any positive results. There were one or two places where a rich streak on one of the walls was noted and the inclusion of portions of this richer ore in the samples show occasional erratic high results on the assay-plans of the other engineers. In my own examination I was careful to eliminate such high-grade streaks from the samples, with the result that practically none of my samples yielded assays of over \$20 per ton.

The difference in method employed in these several examinations will be accentuated when it is stated that one engineer took samples at intervals of two feet, combining a number of samples into one, the total number from the mine being only about ten. Another engineer stated that he started taking one sample at a place where he heard the sound of a hammer; a truly remarkable description, and one that will readily mark the spot by any one who cares to look for it several years afterward!

The Leonesa orebody, as will be seen from the description of its general character, is most difficult to sample, the hard quartz often occurring in thin bands alternating with soft clay and manganese oxide, so that when moiling for the purpose of securing a piece to be included in the sample, the quartz often retreated within its soft encasing material. The manganese oxide was almost as coherent as clay and came away from the face with the greatest ease. The clay was sticky, of course. On the walls there would often be a foot or more of hard resistant quartz. This quartz could be sampled alone, but as the other materials alternated at such frequent intervals it was impossible to take a sample except by including the lot in any particular sample. Yet, despite all these difficulties, the average assay was practically the same.

Another point worthy of note is the variation in the estimate of tonnage. In 1901, engineer B estimated 40,000 tons of ore with practically the same assay-value as ascertained by myself, but his estimate of cost is totally inadequate and is certainly unattainable at the present time, and was more illusive at the time of his examination.

The next engineer finds a considerable additional amount of ore, and a lower working cost. His estimate of cost is also unattainable.

Engineer D estimated 69,000 tons, and included in this total is about 8000 tons which he stated in the body of his report would be omitted from two blocks, on account of ore already extracted from old workings.

After the date of engineer D's report, another engineer, whose figures, unfortunately,

WEIGHING ALLUVIAL-TIN SAMPLES

By E. J. VALLENTINE.

At a time when alluvial tin-mining is attracting so much attention, some hints on the weighing of samples may be of interest.

The unit generally adopted in making quantity surveys of tin-bearing alluvial deposits is the cubic yard, the tin-ore content of which is expressed in aovidupois pounds. However, in the Malay States, where half of the world's tin is produced, it is customary to report samples in katis per cubic yard, the kati (or catty) being a local weight equal to $1\frac{1}{3}$ lb. The usual limit of accuracy required is one decimal place of a pound or of a kati, which expresses the value within a margin of twopence per cubic yard, and, although weighings are sometimes reported to two decimal places, the second figure is obviously a useless refinement.

The size of sample generally favoured is a quarter cubic foot, which is measured in a box with inside measurements 1 ft. square and 4 to $4\frac{1}{2}$ in. high, the extra height being given to compensate for the difference in bulk when 'in situ' and when 'in the loose.' This difference varies according to the nature of the earth or gravel, and must be ascertained by trial.

The sample is then carefully panned, and the tin-ore content dried and weighed. When the grains of ore vary much in size, it is difficult to get a clean product without loss, and two or three small sieves of different mesh are a great help in finishing the separation. A convenient way of drying the ore is in an ordinary metal table-spoon held over a flame.

It is in the weighing that much time is often wasted. An assay balance, in conjunction with ordinary gram or gram weights, is fre-

quently used. As a cubic yard contains 108 quarter cubic feet, the weight of the ore content of the sample is multiplied by 108, and the product converted into pounds or katis, as the local practice may be.

This tedious calculation may be shortened by applying the following tables given below, which are based on the constants.

About four years ago, it occurred to me to apply the assay-ton principle, by having a set of brass weights made to represent 5, 4, 2, 1, 0.5, 0.4, 0.2, and 0.1 katis per cu. yd., so as to get results direct, without recourse to the conversion table. However, while this was a step in the right direction, the assay balance still seemed much too cumbersome and delicate an instrument to use in order to arrive at a weight which only needed to be accurate to within, say, five grains.

Eventually, the daching or Chinese beam weighing-scale was proposed, and a small one, of the type used in retailing opium, was obtained. The bone beam was scraped clean of its original markings, a set of 'assay-ton' weights was made with the aid of some sheet lead, a good balance, and gram weights, and the beam was then marked by trial with the different lead weights.

The daching was thoroughly tested at a mine where many samples were taken daily, and it was found to be just what was wanted, being handy to use and sufficiently accurate, as it proved to be sensitive to about three grains or, say, 0.04 kati per cu. yd. The original was then given to a Chinese daching maker as a pattern, and, as the merits of the device became known, many copies were requisitioned.

$$1 \text{ lb. per cu. yd.} = 64.8148 \text{ grains or } 4.1999 \text{ grams per } \frac{1}{4} \text{ cu. ft.}$$

$$1 \text{ kati per cu. yd.} = 86.4198 \text{ " " } 5.5999 \text{ " " " "}$$

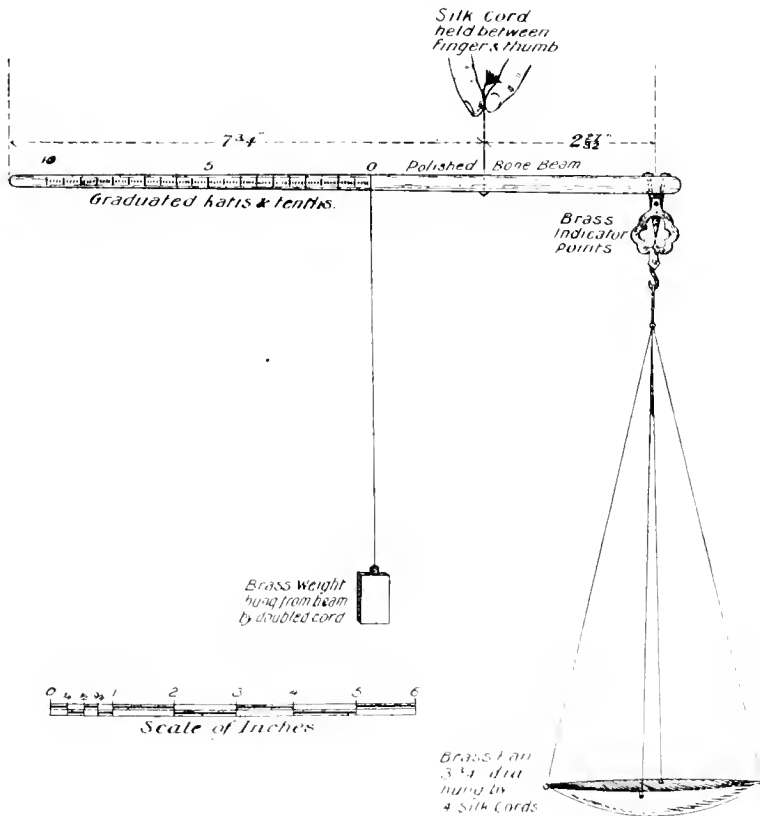
Lb per cu yd.	Grains per $\frac{1}{4}$ cu ft.	Grams per $\frac{1}{4}$ cu. ft.	Katis per cu yd.	Grains per $\frac{1}{4}$ cu ft.	Grams per $\frac{1}{4}$ cu. ft.
1	64.8	4.2	1	86.4	5.6
2	129.6	8.4	2	172.8	11.2
3	194.4	12.6	3	259.3	16.8
4	259.3	16.8	4	345.7	22.4
5	324.1	21.0	5	432.1	28.0
6	388.9	25.2	6	518.5	33.6
7	453.7	29.4	7	604.9	39.2
8	518.5	33.6	8	691.4	44.8
9	583.3	37.8	9	777.8	50.4

It is now largely used in the Malay States, and would seem worthy of the notice of tin prospectors and miners in other countries.

It can be carried in the pocket and used in the field, which is a great advantage on prospecting trips. It can be cheaply and easily made, and, as the idea is not patented or protected, some enterprising instrument maker may see fit to exploit it. The beam could be graduated in pounds and tenths on one side, and katis and tenths on the other, while kilo-

spare piece should always be carried.

The most simple form of daching has no indicator points, the pan being suspended by passing the cords through a small hole in the beam. The drawback is that the poise or level of the beam must be judged by the eye, but this is easier than might be imagined, as a slight move of the hanging weight will cant the beam considerably. Materials for making the beam, weight, and pan can be easily obtained in any locality, but a good balance is neces-



grams per cubic metre for a sample of 0.005 cubic metre (5dm^3) could also be marked on the top.

Before using the daching, it should be tested by hanging the weight on the zero mark, to see if the indicator points agree. The ore is then put into the pan, the weight moved along the beam to the point of equipoise, and the result read from the graduation underlying the cord.

Ivory or bone is the best material for the beam, which should be round and polished, and tapered from $\frac{5}{16}$ in. diameter at one end to $\frac{3}{16}$ in. at the other. The cord should be of strong thread, preferably silk, and a

sary for the making of the assay-ton weights.

An a.t. weight, corresponding to the limit of the range required (say 10 lb. per cu. yd.) is put in the pan, and a hanging weight is made which will balance when suspended near the end of the beam. This point is marked; the pan having been emptied, the zero point is then found and marked; the distance between these two marks is then carefully measured; and the spacing of the intermediate marks is calculated by simple proportion and laid off on the beam. If there be any doubt as to the accuracy of these intermediate markings, they can be checked by additional a.t. weights.

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

A Plea for Scientific Prospecting.

The Editor :

Sir There is always a demand for new mines, and several prominent men, here and in America, have lately drawn particular attention to this matter; but, as a greater part of the world has been explored in a more or less thorough manner and probably most of the more readily recognizable deposits have been discovered, it is evident that future prospecting must be of a more thorough character and carried out in a scientific manner by men who have specially qualified themselves for this work. These remarks apply equally to the discovery of new mines in the jungle and of new orebodies in the mine. It is evident, after due consideration, that what is wanted is a new type of prospector. This new type will be a man who has had a thorough scientific training, who is a geologist and understands minerals and orebodies, their mode of occurrence and genesis. As he will require to examine rocks he will in the ordinary course know something of optics. The old type of prospector frequently knew too much of double vision and interference colours in the shape of the mixed facial colours peculiar to a convalescent black-eye.

A country that has lately suffered from 'prospecting' is Nigeria, but, if we look into the matter, there is no difficulty in appreciating the fact that it has been most improper prospecting, and the notes from which the 'reports' were compiled probably violated the most important, perhaps we may call it the fundamental, rule of prospecting, in that they were made in the office instead of in the field.

Below are given in a few lines, the story of the fiasco of Nigeria and some terse comments on it. The first quotation is from the chairman's speech at the meeting of the Anglo-Continental Mines, Ltd., on March 19 last.

"First as regards the Jemaa property. The chief statements which we had before us at that time were that four miles of lode had been located; that a rich body of ore had been struck showing 25% tin; that the width of the lode was 30 feet; that the rich ore could be traced for 500 yards; that five costean trenches had been cut; and that average samples from these assayed 24% tin. . . . The lode was

stated to have been traced for over eight miles, and for a length of a mile and a half the average width was stated to be 30 feet and the average value over 20% tin. . . . A joint telegram was sent stating that they had examined the lode on the surface and in the costean trenches there was a splendid body of ore, and that judging from surface indications the lode had every appearance of being permanent in depth. . . . After six weeks of steady work, Mr. Balfour cabled that the lode was six feet wide and contained about $\frac{1}{2}$ % tin, that there were patches containing 15% over a foot, that on his arrival the lode had not been defined in any of the trenches, therefore he had defined the lode in four trenches by blasting 150 feet."

The second I cull from *The Mining Magazine* for February:

"Youngsters fresh from a school of mines are no more dangerous than older men accustomed to gold-quartz mining but unfamiliar with tin deposits. . . . The hysterical pronouncements of prospectors, mechanical engineers, surveyors and others unfamiliar with the deceptive likeness of cassiterite to ilmenite, tourmaline, rutile or garnet, have been fruitful of blunder."

The third is from *The Mining Magazine* for April:

"The geological references are unscientific. . . . A ludicrous suggestion is made that a putative dike may become the basis for a large dredging proposition."

Whatever the youngsters fresh from a school of mines would do in the matter of those costean trenches, surely no man, accustomed to gold-quartz mining, but unfamiliar with tin deposits, would make such reports.

As to the hysterical pronouncements of prospectors, mechanical engineers, surveyors and others unfamiliar with the deceptive likeness of cassiterite to certain other minerals, the following facts remain: (a) few prospectors have trained themselves or been properly trained for their work, (b) many mines are under the direction of mechanical engineers when they should be under mining engineers, (c) unfortunately many mining engineers are sadly deficient in their knowledge of geology, both pure and applied.

There is ample room on a large mine for a well-paid mechanical engineer, but the man to direct mining operations, to search for minerals, and to report upon occurrences of the same, is the man who has made a study of mines and minerals. Geological references that can be bluntly described as unscientific must have been made by men not competent to use geology in making reports.

This is an age of science, but, this fact notwithstanding, the scientist has never been received with open arms unless he has made some sudden brilliant discovery. He has always had to fight against ignorance and prejudice, particularly the prejudice in favour of the 'rule of thumb' and the 'practical man.'

Mr. Alfred H. Brooks, in his presidential address before the Geological Society of Washington in December 1911, speaking of the age of 'the practical man' in America, described it as "an era characterized essentially by unscientific thought among the mass of the people. The people, overlooking the fact that the success of the practical man was due to energy and opportunity, attributed it rather to the absence of technical and scientific knowledge."

The scientist has everywhere led the way to great things. It was in the laboratory that steel and other metals have been brought to perfection; that dynamite, fulminate of mercury, picric acid, and other explosives were first made; in fact, chemicals and the microscope have everywhere led the way to new discoveries and a clearer knowledge of how things are done in Nature, and the scientific prospector can no longer get on without them.

The old prospector achieved great things, for he often endured hardships, and made many discoveries; but it remains to be proved how many 'good things' he has walked over without being cognizant of the fact.

Again, how often do we read of the large tracts of land held by mining and other companies without any idea of its possible or impossible value, not having been prospected, and remaining an asset of possible potential value: in other words an empty phrase wherewith to conjure or to fence at annual meetings.

The importance of the Rand was not at first recognized, and even when this had been to some extent realized and after the practical men had blasted and stamped (possibly 'stamped' and 'blasted' when they found themselves able to extract only an inadequate percentage of the gold) it was not until the scientist came along with an attenuated form of a deadly poison and extracted the bulk of

the remaining gold, that the Rand became the tremendous success it has been. The Broken Hill mine was a great mine, but the scientific metallurgists have made it greater.

The valuable discoveries on old abandoned claims reported from Australia and elsewhere, from time to time indicate the necessity for a closer study of other old mining districts in the light of a later and better knowledge of ore deposition, and also in view of the greatly improved metallurgical methods, for many refractory rocks of former days would now be classed as ore and yield substantial profits upon treatment.

Mr. Bedford McNeill, in his recent presidential address to the Institution of Mining and Metallurgy, gave a prominent, because premier, position to prospecting.

Recent events have drawn attention to the various phases of speculation, and as much prospecting must of necessity be of a speculative nature, we should look to it that the speculation has an ultimate scientific basis.

The proved recurrence of zones of richness and poorness (apart from secondary enrichment or impoverishment) of gold and other deposits, points clearly to the necessity for a more thorough investigation, on modern lines, of unpayable outcrops in mineralized districts, for it is quite illogical to suppose that all lodes have been conveniently eroded to a point when their payability or non-payability can be determined by surface sampling. To argue otherwise is to suggest that Creation was retarded until this very desirable end was accomplished, and the absurdity of this point need not be laboured.

The Treadwell mines of Alaska are prominent examples of mines that have passed through rich and poor zones, followed by further rich zones at greater depth.

Then there is the Kolar goldfield. The position on this goldfield was ably summed up at the beginning of this year in *The Mining Magazine*: "In the older district of Kolar the most important event is the improvement of the ore on the deepest levels of the Champion Reef mines promising to revive its earlier glories. On the 43rd level in the Carmichael section the lode averages 25 dwt. over six feet. . . . At the Hutti mine in Hyderabad, the deeper exploration at 2000 feet has revealed the presence of profitable ore."

Detailed information of the latest improvements in depth of these famous Indian mines will be found in the speeches of Mr. Edgar Taylor, notably with regard to the Ooregum.

The Great Fingall, in West Australia, pro-

duced £75,000 from 30,000 tons of ore when the first lens cut out at 150 feet. The mine was within an ace of being abandoned, when fresh capital was raised and sinking continued, and a fresh lens cut at a depth of 400 feet. This continued until 1500 feet before pinching out and yielded £6,700,000 from 1,773,200 tons of ore; but they had not done yet, for after sinking a further 740 feet through country a new orebody was found, and this has been developed to 2500 feet.

Deposits in andesite are not usually expected to continue to great depth, but the Braden copper mines, situated in the Andes, seem likely to be an exception. At the Braden mines the ore occurs as vein-filling in the fractured andesite. Parts of the deposits occupy an old fumarole, and the copper ores are essentially primary, to the extent of dating back to the original process of silicification and mineralization accompanying igneous activity. The No. 4 level was already 2500 feet below the outcrop in July 1911, and enormous quantities of ore assaying 27% copper had been developed.

The few instances cited above serve as reminders of successful deep mining. Other instances might be cited of successful mining at much greater depths, but the cases mentioned happened to be at hand in my note-book.

There is, of course, a limit to all veins, for in time we will get to the roots, that is to a point where at the time of mineralizing activity the rocks were in a more or less viscous condition and could form neither fissures nor even planes of weakness suitable for ore deposition. In this connection it must be remembered that deep erosion removes the wider parts of fissures, so that only the roots may remain if the erosion is continued for a sufficient length of time; and, as F. Lynwood Garrison has said, "the more stable an area has been through its geologic history the greater the erosion to which it has been subjected and the less productive have been its mineral lodes."

Applied geology, particularly when studied in connection with prospecting and the exploitation of ore deposits, is a very wide subject. It cannot be learned in a week or a month, and there is no short cut to a proper understanding of the subject. There are no simple rules whereby gentlemen with but a short time at their disposal and with no previous knowledge of the subject can be rapidly prepared to undertake the highly responsible work of prospecting a mining claim, a mine, or the jungle.

There is no simple principle governing all deposits, and though there are a number of useful rules which often hold good, there are many modifying influences always to be considered; what holds good in one district may not hold good in another. As an instance, the presence of underground water is often a favourable sign, but at Kalgoorlie the mines on 'the golden mile' are very dry, while those outside this area are wet and produce very little ore. As a further instance, in some districts the narrower veins are very rich, but in the Pis Pis district, Nicaragua, the rule throughout the district is that the wider portions of the quartz veins are richer in gold than the narrow.

Some problems of prospecting and applied geology are more difficult to solve than are others, and some men will find the solution of any problem, geologic or otherwise, more difficult than will other men.

There is a great deal yet to be learned about the application of geology to prospecting and mining, but much is already known, and, that we do not know all is no adequate reason why full use should not be made of the knowledge that we already possess.

It was the practical application of geology that killed the old idea as to the unlimited vertical extent of the 'true fissure vein,' and that has helped in the past, as it will help in the future, to extend the limits of old deposits and to find new ones.

STEPHEN J. LITT.

London, April 30.

Transvaal Tin Deposits.

The Editor:

Sir—Since the discovery, some six years ago, of cassiterite in commercial quantities in the Central Bushveld area, numerous articles have been written on these deposits, the latest being those in the *South African Mining Journal* of December 14 and 21 and January 11.

In these articles it has been assumed that these deposits of cassiterite have originated from "tin-bearing vapours, and gases, which have risen to the surface of the magma" and that these "tin deposits favour the upper granite horizon." It is further argued that, as the deposits of cassiterite have originated from tin-bearing vapours and gases, the known occurrences may extend to a considerable depth, "a depth equal to the lowest working in the Dolcoath mine," also that as the tendency of tin-bearing vapours and gases is to rise to the surface of the magma in which they

have originated and to "favour the upper granite horizons," the claims that have been pegged on the lowest horizons are in "a presumably unfavourable situation." The views expressed in the said articles are calculated to raise the hopes of the owners of claims on the upper granite horizons and to dampen the enthusiasm of those on the lowest horizons.

The low-lying ground forms by far the greatest portion of the Central Bushveld area, and it is fortunate, therefore, from an economic point that the data obtained from actual mining give no evidence whatever to support the theory that these deposits have originated from tin-bearing vapours and gases.

About four years ago I first visited the Central Bushveld, but at that time sufficient mining work had not been done to enable anyone to express a definite opinion as to the nature of the tin occurrence, and the probability of its continuance in depth. It appeared to be a secondary enrichment occupying fissures or fractures of limited depth, but none of the fissures had at that time been 'bottomed'; and, therefore, although a careful examination of the mineral, coupled with other observations, warranted the opinion that the occurrence was a secondary enrichment, it was not possible to express a definite statement as to the depth to which these fractures would extend.

I have recently re-visited the region, and find that in the Potgietersrust district in the northeast and also in the Warmbaths district in the southwest, the greater number of fissures have ceased to exist, and that the remaining ones show unmistakable signs of disappearing. For obvious reasons it is inadvisable to give the names of particular mines.

A careful observation failed to find any evidence that the pipes or fissures were mineralized by "tin-bearing vapours and gases," and that the source or "parent body" is somewhere below the deepest working. There is, however, evidence that the so-called 'pipes' or fissures are fractures caused by mechanical stress or strain, and that their cassiterite contents are derived from the erosion or denudation of formerly overlying rocks containing cassiterite. In other words, the rich cassiterite found in these pipes and fissures is a secondary mineral derived from the erosion of rocks that formerly overlay the present surface in considerable thickness.

There is evidence of great erosion in the Central Bushveld area, and careful observation points to the conclusion that, although particular zones of fracture may not have a

great extent, either laterally or in depth, yet there are other zones of fracture in this area yet to be discovered, and that in consequence of the immense thickness of the formerly overlying rocks, which contained cassiterite, these yet-to-be discovered zones of fracture will be as rich in cassiterite as those already found; also that the particular class of rock in which these fractures exist has no bearing on the economic value of the deposits; in other words, these cassiterite-bearing fractures may occur in red granite as at Zaaipplaats or in quartzite as at Rooiberg, and that they are as likely to be found on the lowest horizon as on the highest.

G. H. BLENKINSOP.

Johannesburg, April 10.

Mine Plans.

The Editor:

Sir—Although I have no direct interest in the Ivanhoe Gold Corporation, I think it advisable to draw your attention to the parsimonious policy foreshadowed by Mr. F. A. Govett in suppressing the publication of plans from future reports.

The plans published by this company for a number of years have been real models in giving the shareholders technical information. If more companies had conformed with such a standard of publicity and evidence of good faith, there would have been fewer complaints about secrecy and inside manipulation. Time upon time I have urged other concerns to adopt the Ivanhoe standard, and, personally, I must admit that the lucidity of these plans and the facility of following the progress reports in conjunction with them, has enabled me and a number of friends to realize our holdings, and prevent a considerable loss.

To suppress these plans, just at a moment when some important developments and improvements are predicted by the most eminent authorities on mining and geology, is a step in the wrong direction for the Ivanhoe shareholders.

It is also deplorable in general that this good example set for years to others, should be sacrificed by a financially strong concern on grounds of economy, and that it should be sacrificed by the mouthpiece of that much heralded new mining group professing to march under the flag of efficiency, honesty, and fair-play.

I do not ask you to print this letter over my signature, but for the sake of all the principles and ethics in mining which you have been preaching in the past, I trust you will

take the matter up and treat it in your own masterly style.

F.R.

London, April 30.

Our correspondent voices the opinion of the intelligent shareholder. It happens that in another part of this issue we have welcomed the resumption of the practice of including mine plans in reports of some of the Rand companies.—EDITOR.

Speculation and Investment.

The Editor:

Sir—I have read with interest your remarks about the legitimate realization of investments, affording a profit due to the appreciation of the capital value of the stocks or shares, and I have also followed your views expressed from time to time to the effect that greater profits are made by rises in market quotations than by the division of profits earned by the mines themselves. There are some aspects in connection with this subject that deserve consideration from the point of view of the ordinary shareholder, whether investor or speculator. In the first place there are very few shareholders, skilled in mining or otherwise, who are sufficiently sagacious to make money by a rise, so that to follow your implied advice would probably end in failure. I would point out that the rise or fall of a share quotation usually depends on influences beyond the control or knowledge of the ordinary shareholder, and that bullish enthusiasm and bear panic are usually prompted by the controllers on the Stock Exchange, the former for the purpose of disposing of shares that had been bought cheap, and the latter for the object of frightening weak holders out of their possessions. It is obvious that the profits made by the appreciation of share quotations go to the insider, and that the difference in the level of share quotations is generally equivalent to a loss for the average shareholder.

My second point is that your advice with regard to profits arising from appreciation in share quotations, even if secured by the average shareholder, is necessarily one-sided; it is in favour of the knowing ones and to the disadvantage of the others. A lucky shareholder may see his shares for which he paid par value go up and up, until the quotation stands at £10. He then sells, as he is of opinion that the shares are not intrinsically worth that amount. The buyer may consider the shares a suitable purchase at that price, but he is probably wrong, for the seller under such circumstances is obviously exercising a sounder

judgment. Thus the advice and counsel on the part of your Magazine is not on the side of those participators in mining speculation that require the greatest protection. In other words, the views of the Magazine are coincident with those of the knowing ones. I would urge that advice about speculation and investment should be for the benefit of all readers and of the community in general. And it follows as a corollary that the average investor should be encouraged to look for returns from the mine and not from the Stock Exchange. As a matter of fact the large majority of shareholders in mining companies hold their shares for the dividends. If everybody thought it best to sell out of Mysore at the present time, the shares would collapse. Everybody could not realize the benefit of the high price of the shares as now quoted. The advice with regard to selling at a profit does not hold good equally for all shareholders. The fact that the quotation is maintained at so high a figure proves that there are no sellers and that every one is relying on a profit from the mine and not from the Stock Exchange.

I would also urge that silence is sometimes more efficacious than advice. To tell the professional man not to speculate tends to develop an embryonic thought better left to perish of atrophy, and is reminiscent of the Irishman's celebrated advice to the mob: "Don't nail his ears to the pump." In other words, the negative advice may provide a suggestion that would not otherwise arise.

It may seem Utopian or even Sunday-schoolish to wish to suppress Stock Exchange speculation, but my views are founded on basic economic principles and not on sentiment. The transference of £100 from one person's pocket to another's without any *quid pro quo* except sad experience, is not the principle on which a thriving community can be built.

SHAREHOLDER.

London, April 25.

The Iridosmine found in the Rand banket is described by R. B. Young as being in the form of rounded grains or of crystals that have their edges worn to a greater or less degree. He has not yet seen any crystals with sharp edges and smooth faces. Thus he judges that the iridosmine was an original constituent of the conglomerate and was not of secondary origin. Chromite is also in the banket in rounded form, and the two apparently were of detrital origin, coming from the ultra-basic rocks of the Swaziland System.

large and practical scale. A satisfactory solution of this problem would be beneficial also to the mines like the Lancefield and Transvaal, where the ore is associated with antimony and arsenic.

In the Leonora district the Sons of Gwaha still holds pride of place as a producer and large employer of labour. The Lancefield at Laverton is unfortunately idle at present, but efforts are being made to re-start it in the near future.

Of the smaller districts Comet Vale is steadily coming to the front. The mines there are developing well, and one of them, the Sand Queen, is paying regular dividends.

There is nothing special to chronicle concerning Kalgoorlie, which is still employing about the same large number of men as heretofore. The Hainault has ended its career as an independent mine, and has amalgamated with its neighbour, the South Kalgurlh.

In copper, the only notable developments are at Whim Creek. The company has adopted a magnetic separation process, and the new plant is in operation. At Ravensthorpe, the Phillips River company is in liquidation, having failed to raise the necessary capital to enable it to reconstruct and resume operations.

The high price of tin has been maintained during the year and that has enabled the mines at Green bushes and elsewhere to make a little more profit.

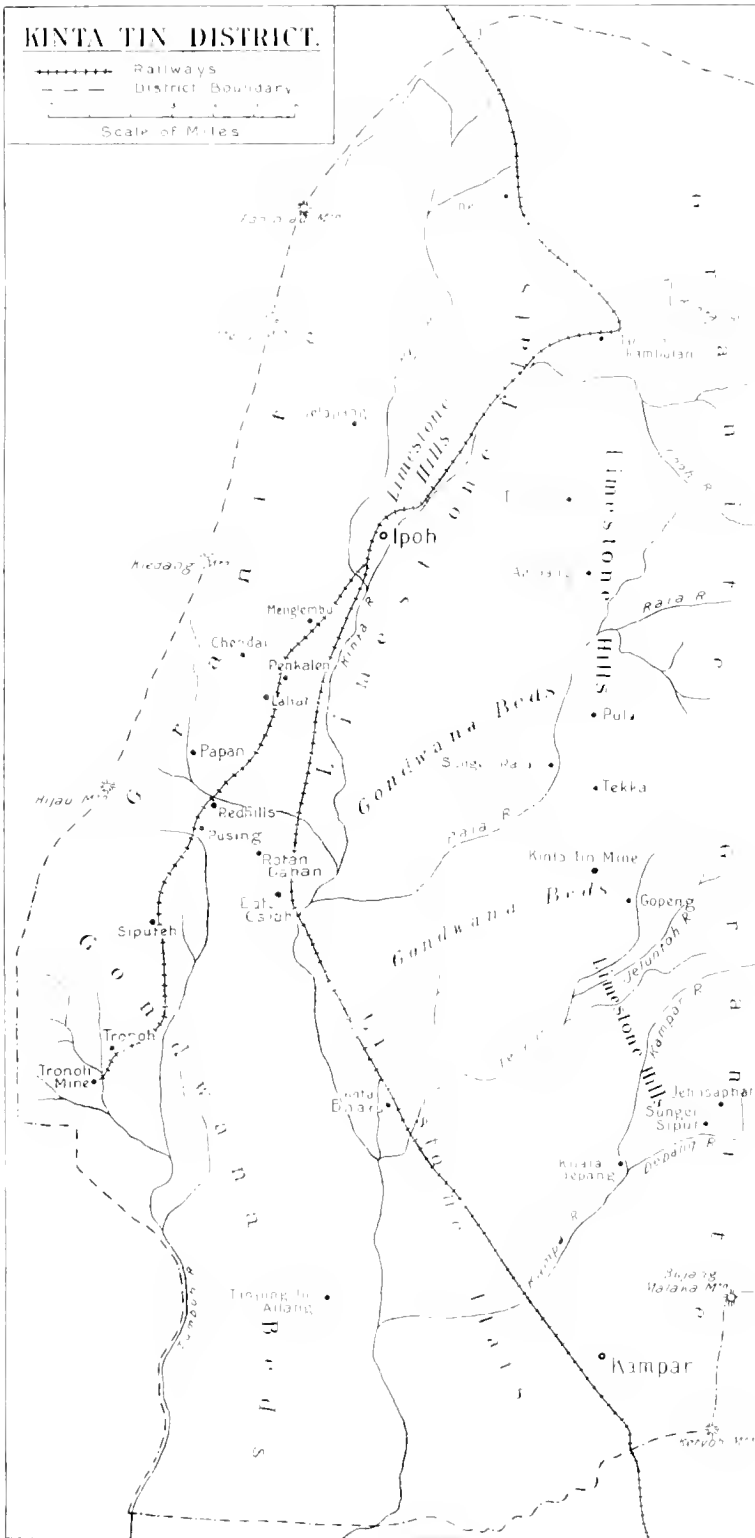
Deposition of Silver and Gold in Nature.—In *Economic Geology* for March, C. Palmer and E. S. Bastin give the results of their experiments in connection with the function of metallic sulphides and arsenides, such as chalcocite and niccolite, in precipitating silver and gold from natural sulphate and chloride solutions. These studies were made for the United States Geological Survey, in connection with the chemistry of secondary enrichment. The experiment on which the paper is based showed that if such minerals are suspended in, or otherwise brought into contact with, solutions of silver sulphate or gold chloride, the precious metal is deposited on the mineral. Proceeding from this result, the authors conducted a series of experiments with various minerals, and applied their conclusions to the study of the formation of ore deposits. These conclusions afford explanation of the association of native silver with nickel-cobalt arsenides and with chalcocite.

Tungsten in Nova Scotia.—At the October meeting of the Colorado Scientific Society, Victor G. Hills described the occurrence of scheelite, that is, tungstate of lime, in Halifax county, Nova Scotia, and the method of concentrating the ore. The scheelite is found in veins that have the same structure and characteristics as the gold veins of the neighbourhood, and described by T. A. Rickard in his paper on the 'Domes of Nova Scotia'. That is to say, the veins consist of quartzite verging on greywacke, and pass in crenulated form through Lower Cambrian slates. Associated with the scheelite are ankerite, that is, iron-manganese-lime carbonate, and arsenopyrite, with small quantities of pyrite, calcite, and tourmaline. The scheelite is apparently primary, seeing that no wolframite has been found, and that there is a clear line of demarcation between the ankerite and the scheelite. The scheelite and arsenopyrite were the earliest deposited, and they are frequently found brecciated, with the fractures filled with quartz. Though no granite outcrop is in the neighbourhood to account for the presence of tungsten compounds, yet Mr. Hills is of opinion that the granite is at no great depth. A small mill to treat 1 ton of ore per hour was erected in 1911. It consists of rolls and a table. The problem is to make as little slime as possible, for both the scheelite

and the slate wall rock are softer than the quartz and ankerite. The concentrate consists of scheelite and arsenopyrite, they having practically the same specific gravity, 6. In order to separate the two minerals, it was first proposed to drive off the arsenic by roasting and re-concentrating magnetically, but it was found afterward that it was best to give a magnetic roast, and so make the arsenopyrite amenable to the magnet, thus avoiding the time difficulty. The product as sent to market contains 70% tungstic acid, and the recovery is 86%. It is not economical to dress cleaner. In view of the slime problem, the percentage of recovery is satisfactory.

Geology of the Kinta Tin District.—The Government of the Federated Malay States has published a report by J. B. Scrivenor on the geology of the Kinta valley, in the State of Perak. The district contains many mines of note, such as the Gopeng, Tronoh, Tekka, Sambun, and Pusing Bharu. This contribution by Mr. Scrivenor to geological knowledge is one of unusual importance, for it elucidates the many varying types of occurrence of cassiterite in rock, clay, alluvium, and surface soil, and disentangles many confusing conclusions of previous observers. The chief error hitherto extant has been in connection with the age of most of the deposits now being worked by hydraulic methods. It has been assumed that these deposits are alluvium of recent origin, but this is shown by Mr. Scrivenor to be a vital error, and that the deposits form part of the Gondwana series, belonging to the Upper Carboniferous and Lower Mesozoic ages. This series of rocks forms a large portion of India and other countries in the east, and corresponds in time with the Karroo system of South Africa. Mr. Scrivenor shows that these deposits are quite different in origin from the surface alluvium worked in years gone by, which were of recent origin. He also shows that at the borders of the granite on both sides of the district, there is much cassiterite in the soil, and that no doubt the modern alluvial deposits were also derived from this source. But these two ranges of granite are of later geologic date than the Gondwana series, and therefore the cassiterite contained in the latter must have come from some older granite, the locality of which is unknown. There is yet another source of cassiterite, for it is found associated in many places with still more recent intrusions of granite through the floor of the valley.

Crystalline limestone older than the Gondwana series forms the bed of the valley, and is found as precipitous hills, especially on the east side. Upon the limestone lie beds of stiff clay and boulder clay, and in some places phyllites and quartzites are found on the top of the latter. Geologists have usually supposed that these clays were of recent origin, and that the phyllites and quartzites were older than the limestone, because the outcrops of the latter are usually at a greater elevation. Mr. Scrivenor however shows that the elevation of these limestone ranges is due to a system of faulting induced during the contraction of the earth's surface, whereby the parts of lower present altitude slid downward. Mr. Scrivenor adduces evidence to show that the boulder clay is of glacial origin. It consists of fine clay, angular sand, and boulders of all sorts, such as quartz, schist, tourmaline-corundum rocks, pure corundum, tourmalinized sandstone, etc. The cassiterite is not water-worn as is the case with true alluvial deposits, but has fairly sharp corners. The reason for these clays being sufficiently friable to be broken by hydraulicking is that much of the silica has been dissolved by the ground-water. In many places the clays are covered with sandy deposits containing



a species of lignite, and all is covered by recent alluvium or soil. It is obvious that the considerations brought forward by Mr. Scrivenor present opportunities and guidance for further prospecting, and in fact he indicates numerous areas where such investigations would be promising. His report will create great interest among geologists and is well worth intimate study. We have prepared the accompanying map from that which accompanies the report, and we may add that the report also contains many illuminating diagrams and photographs. In our next issue we shall return to this report in another column, and discuss some of the conclusions.

Losses in Tin Dressing. At the meeting of the Association of Cornish Mining, Mechanical, and Metallurgical Engineers, held on April 5, William Thomas read a paper discussing the losses incident in the dressing of Cornish tin ores. After reminding his hearers that the introduction of the chemical assay was not the occasion when these losses were first disclosed, but that the assay only confirmed in a scientific manner a matter which was of common knowledge, he proceeded to refer to the disinclination of most mine managers to investigate the causes and remedies. The average manager in the old days, and even now, did not care about sampling his tailing. He was keener on mixing it with tailing from other mines as soon as possible and so sharing his burden with his neighbour, by discharging them into the streams, or, better still, by sending them over the cliffs. However, systematic sampling of tailing had been introduced at some mines of late years.

In addition to sand and slime losses and losses after roasting, there were other losses to be reckoned, which in mines handling complex ores were considerable. Some of these losses had been substantially reduced of late years. For example, not long ago it was not unusual for a parcel of wolfram, as sold, to carry 15 to 20% of black tin. This has now been reduced generally to 2 or 3%. Black tin as sold a few years ago from 3 or 4 of the leading mines carried from 6 to 9% of tungstic acid, and such parcels of tin were heavily penalized by the smelters. Mr. Thomas quoted correspondence and notes relating to endeavours made, on the initiative of the late professors Le Neve Foster and Bauerman, to introduce the Wetherill magnetic separator into Cornwall in 1898. In September of that year, the lecturer called on East Pool and other mines with Alfred Martin, of Frankfurt, who then represented the Wetherill patents in Europe. The effort was unavailing as far as Cornwall was concerned, but Mr. Thomas exchanged ideas with Lake & Currie in 1899, and they, with Joseph Richards as manager, erected on their San Finx mines, in Spain, the first Wetherill machines applied commercially to tin and wolfram ores. Complete success was obtained, and the San Finx example was promptly followed at the Clitters mines in east Cornwall.

If all sources of loss were taken into account and due allowance made for inaccurate weighing of the ore, the average loss of tin in Cornish mines at the present time was not less than 40%. He did not know a Cornish mine where the loss was less than 30%. He knew of some where it exceeded 40%, and in two cases he had investigated it approached 60%.

Mr. Thomas then proceeded to indicate lines along which improvements might be made in the treatment of tin ores in Cornwall.

(1) By avoiding unnecessarily fine crushing. This involved substituting a coarser screen in the stamps, and adopting stage crushing. The first tube-mill ever inserted as a permanent part of an automatic plant in

Cornwall was that put in by Mr. Thomas at King Edward mine about 10 years ago. One of his successors removed it, but at South Crofty, East Pool, and several other mines tube-mills now formed a permanent and efficient feature in the plant. The use of tube-mills at this stage of crushing necessitated the selection of a suitable concentrator immediately below the stamps. He had strong reasons for declining to favour any concentrator below the stamps that could not be made to yield one finished product at the outset, that is to say, valueless tailing. There were concentrators in plenty on the market that, on most Cornish tin ores crushed through a 10 to 15-mesh, would yield a considerable portion of coarse tailing running under 5 lb. It was a great advantage to get rid of this at once. No profit could be made out of it. If ground to slime, it ran to waste at 10 lb. instead of 5 lb., stealing tin from the richer portions of the ores.

H. W. Hutchin proved with his heavy solutions that certain portions of the matrix carried practically no tin. This entirely confirmed his own observations on lode-structure in general, and the distribution of tin throughout the lodes. As a rule, the distribution was not uniform. Tin was confined, in the main, to leaders, branches, or parts of the lodes, while other parts were practically barren. If in a granite capel, the tin was not in the quartz, but in the altered felspar. It was essential to select a concentrator that should discard a substantial portion of those barren grains, in as large a size as possible; thus following up, automatically, the hand selection begun on the spalling floors or the picking belts; and for precisely the same reasons.

It was notable that, following the lead of South Crofty, several other mines in various parts of the county had abandoned the 20, 25, and 30-mesh screens, or their misleading equivalents in the form of punched grates, in favour of 10, 12, and 15-mesh screens. In every instance, satisfactory results had followed the change. There was a limit, of course, to the range of coarser crushing, and in the author's opinion the limit was about 10-mesh.

(2) It was time to substitute automatic plant for the hand-treatment of roasted ores. Automatically-fed machines, whether grinders or concentrators, would handle more stuff and maintain a more uniform set of conditions. Experiments in this section were enforced at King Edward mine in the early days, because no other plant existed. They were entirely successful. The first mine to erect such a plant on commercial lines was Stormsdown, in Devonshire, by Ernest Terrell, followed just after by Josiah Paull, at South Crofty, with considerable elaboration. Stage-crushing formed a main feature in that plant.

(3) The roasting furnaces in use in Cornwall were defective for complex ores. The Brunton furnace was not sufficiently supplied with oxygen when treating such ores carrying a high percentage of sulphides. Those in charge of the furnaces did not always distinguish between temperature and combustion, and, finding something going wrong, were apt to 'stoke up,' and so commit a folly in innocence. Another serious defect in the Brunton was its inefficient stirring gear. Portions of the charge were never in actual contact with the heated air. It was not surprising that arsenic stayed in the charge and gave trouble to the smelter.

Temperatures were, as a rule, raised much higher than they need be in Brunton furnaces in Cornwall, and he strongly suspected that the consequent evils extended farther than he had intimated.

(4) Classification at the outset was essential. It

seemed late in the day to refer to this first law of ore-dressing. It had become fairly general in Cornish mines, but a few still maintained the old-fashioned disregard of this essential.

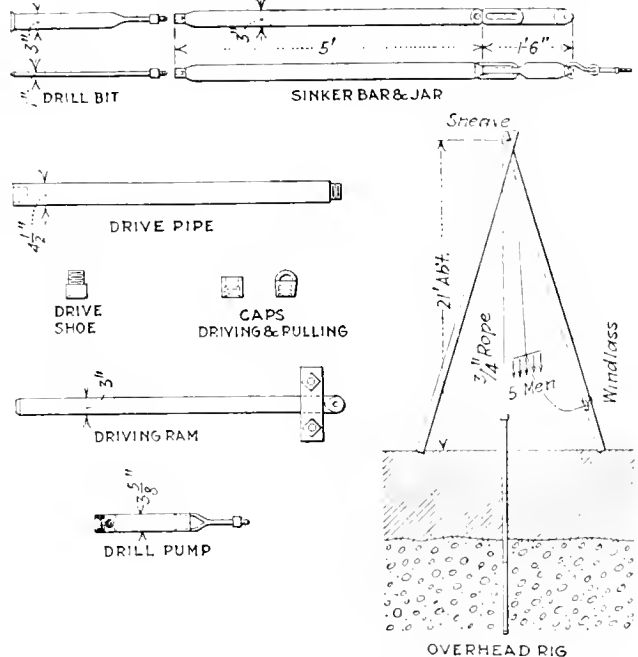
(5) An investigation of the burnt leavings question was important. In this matter those who were attempting to work out a commercial method of chemical extraction had, in his opinion, excellent opportunities for a start, much better opportunities than the raw ore afforded.

Hand-Drill for Testing Placers.—In the *Colorado School of Mines Magazine* for March, William F. Ward describes a churn-drill worked by hand that he used in testing placers in Colombia. He calls the system a combination of Keystone and Empire methods, though as there is no rotation and as the weight of the men is not utilized, the similarity to the Empire or Banca type of drill is not quite obvious. But as the plant was supplied by the New York Engineering Co., the makers of the Empire drill, the use of the name is explained.

The following is a description of the parts, as illustrated: The drive-pipe is in 5-ft. sections, outside diameter $4\frac{1}{2}$ in., ends upset on the inside allowing coarse threads, and flush joints on the outside; the flush joints make it possible to pull by hand, as outside sleeve joints would make hand-pulling difficult. The drive-shoe is plain, and bevel on the inside. The driving-cap is to protect the threads on the top pipe. The driving ram is made of 3-in. shafting, 6 ft. long, with 4 by 14-in. driving-clamps or blocks; a hole is made in the upper end for the rope-hook. The drill-bit is 1 by 3 in. in section, and is pointed according to the work to be done. The drill-pump is of the Empire type and consists of a heavy pipe, $3\frac{3}{8}$ in. outside diameter, fitted with a nickel-steel hollow bit and ball-valve; the gravel enters the pump as it is broken, drilling and pumping thus being done at the same time. The vacuum pump has an outside diameter of 3 in., and is similar to the usual Keystone pump. The sinker-bar consists of 3-in. shafting and is 5 ft. long; the jar is 18 in. long with 6 in. play; the top of the jar has a hole to receive the hook, and the bottom of the sinker-bar has a coupling to fit the conical coupling of the drill-bit or drill-pump. The rope is of hemp, and is $\frac{3}{4}$ in. diameter and 100 ft. long. The windlass is 4 in. diameter, with a handle having a 16-in. arm, and is fitted with a small hand-brake. The over-head rig consists of four poles each about 23 ft. long, and a 7-in. sheave; the windlass is fastened to two of the poles. The pulling pole for removing the pipes is generally about 8 in. diameter and 25 ft. long.

The operation of the drill is as follows: After the rig is erected, the driving ram is lifted by the windlass so as to settle the rig and to fix the centre of the hole. The ram is then raised, and two lengths of pipe, fitted with drive-shoe and driving cap, set in place, and driven into the soil or gravel by the ram. The first blows are given by employing the hand-brake on the windlass, but afterwards the rope on the windlass is partly unwound, and a stout stick about the size of a shovel handle is fastened to the rope, so that 4 to 6 men can take hold. As the rope passes over the sheave at the top, the men have to pull downward in order to

raise the driving ram, and then by lifting the stick quickly, they allow the ram to drop freely. The stick is afterwards slipped out of the rope, and the windlass used to lift the ram from the pipe. The hook of the rope is transferred to the sinker-bar and jar, with the drill-pump attached, which are lowered into the pipe. Water is added, and the drill-pump worked by the men, gentler blows being given than when driving the pipe. The pumping is continued until a core of about 1 in. is left in the shoe of the pipe. The position of the core is recorded by marking on the rope the combined lengths of the driving cap, pipes, and shoe; thus it is only necessary to note the distance of this mark on the rope above the driving-cap. The pipe is also marked on the outside, and the depth of the drive-pipe is also noted in the log. As a new pipe is added, its



length is marked on the rope.

When the work begins in the gravel below the soil, the pipe should be driven only 6 in. by the ram. On account of the bevel on the shoe, and the smaller diameter of the inside of the pipe, the core is usually 7 or 8 in. for this 6 in. drive. Driving more than 6 in. with a 4 in. drive-pipe is not satisfactory, for the core does not increase in proportion, with the result that the gravel is stuck in the bottom of the pipe and crowded out. After the driving-ram is removed, the drill-pump on the sinker-bar and jar is let down the pipe, the core noted in the log, and combined drilling and pumping of the core of gravel started. When about half of the core is drilled, the drill-pump is pulled up by the windlass, and another drill-pump substituted; this is let down by the hand-brake, and drilling is continued until $\frac{1}{2}$ in. to 1 in. of core remains. Then the core is noted in the log, the tools removed from the pipe, and the pipe driven another 6 in. Thus by alternate driving, and drilling and pumping of the core, the hole is put down to bedrock. The suction-pump is generally used at the last cleaning-out, and although the main working-rope can be used, it is

more convenient to use a light rope and a small overhead pulley

The pulling of the pipe is done after changing the driving cap for a pulling cap, and fastening to it the end of the pulling pole by means of a heavy chain, and placing an iron fulcrum stand close to the pipe. This work is easily done by first moving the overhead rig to a position such that the rope can be fastened near the centre of gravity of the pulling-pole, and using the windlass for moving the latter. The iron stand has a line of holes, and when the pole is raised, a 2-m. steel pin is slipped into the proper place for the fulcrum. When all is ready the men pull down on the pole gradually until everything is settled. Then the men mount and straddle the pole, and spring up and down until the pipe moves, and the end of the pole touches the ground. The pole is again raised by the windlass, the steel pin changed, and the process repeated until one section of the pipe is raised. This section is removed and the operation continued. We are indebted to the *Engineering and Mining Journal* for the use of the illustration accompanying this précis.

Government Leases on the Rand.—We have already referred to the scheme of government leases introduced in the last gold-law as a substitute for the ancient and more exciting method of pegging, and have shown that with the exception of the Modderfontein area, secured by the Barnato group, no ground has been leased on the new system. The offer of the Brakpan-Schapenrust properties has been received coldly by the financial houses, as has also the Witpoortje. In order to make clear the terms of these leases, the *South African Mining Journal* for March 29 applies them to the six producing mines in the far east Rand, and shows how the actual and speculative value of the shares would be injured. The following table is prepared from the Chamber of Mines analysis for January last:

Mine.	Recovery		Costs		Profits	
	per Ton	per Ton	per Ton	per Ton	per Ton	per Ton
	Milled.		Milled.		Milled.	
	s.	d.	s.	d.	s.	d.
Brakpan Mines	30	8	17	4	13	3
Geduld	27	9	21	7	6	1
Modder B	34	10	17	5	17	0
New Kleinfontein	27	10	18	3	9	3
New Modderfontein...	38	1	20	2	17	6
Van Ryn	27	10	15	10	12	0

Assuming that these companies were working under the conditions of the Brakpan-Schapenrust and Witpoortje terms of lease, the proportion of profit accruing to the public revenue and to the companies would be as follows:

	Percentage of Profit to Recovery.	Government Share of Profit.		Company's Share of Profit.	
		s.	d.	s.	d.
Brakpan Mines	43	5	2	8	1
Geduld	22	1	4	4	9
Modder B	50	7	2	9	10
New Kleinfontein ...	33	3	0	6	3
New Modderfontein	46	7	0	10	6
Van Ryn	43	4	8	7	4

Such a reduction in the profit per ton would seriously decrease the dividends, and would leave little speculative interest in the shares. This would not matter so much to the type of investor to whom South African gold mines appeal, that is to say, those who look more to steady returns than for appreciation in capital value of their investment. On the other hand, it hits the South African financier hard, for it is to the appreciation in the capital value of the shares that he looks for compensation for the risk taken by him in providing

an immense capital for an unproved property. The figures given by our South African contemporary show clearly the reason for the shyness of financiers with regard to government leases. No doubt if the Modderfontein area were offered now, in the light of present knowledge, there would not be the same competition for the prize.

World's Production of Metals. The *Engineering and Mining Journal* for April 12 gives statistics of production throughout the world of gold, copper, lead, zinc, and iron, during the last forty years. It was only in 1879 that reliable statistics for copper were available, while the production of lead and zinc was first summarized in 1873. Figures for gold and iron were issued twenty years before. In some cases the outputs of individual countries were made known many years previous to the limit quoted by our contemporary, and during some periods, the world's production of each metal had been published. But the dates in the following table provide the earliest statistics that come within the general scope of reliability:

Year	Copper, Metric Tons	Lead, Metric Tons	Zinc, Metric Tons	Gold, £	Iron, Metric Tons
1871				107,000,000	13,874,315
1872				90,690,000	13,861,074
1873			297,570	96,200,000	15,170,115
1874			331,150	153,155	90,800,000
1875			352,791	160,532	13,004,179
1876			349,004	179,432	10,700,000
1877			333,226	200,518	11,073,446
1878			353,499	206,878	11,000,000
1879	151,376	359,044	207,016	169,000,000	14,473,064
1880	156,404	352,742	212,252	167,000,000	14,130,081
1881	166,005	387,592	262,365	163,162,000	20,639,461
1882	184,620	407,021	278,506	162,000,000	21,401,867
1883	202,697	444,216	284,331	95,400,000	21,729,202
1884	223,884	437,224	298,011	101,700,000	20,150,042
1885	229,315	435,175	298,986	100,000,000	19,792,300
1886	220,699	447,966	298,960	106,000,000	20,862,989
1887	226,492	446,194	306,113	105,775,000	22,977,983
1888	262,285	635,341	321,791	110,197,000	24,016,705
1889	265,516	595,926	335,359	123,480,000	26,030,266
1890	271,065	586,693	347,200	118,848,760	27,431,229
1891	280,138	620,686	363,084	130,650,000	26,219,525
1892	309,113	645,435	374,772	140,292,600	26,978,619
1893	310,704	640,984	374,915	158,337,551	25,296,746
1894	339,075	617,654	384,207	182,569,283	25,847,352
1895	339,991	650,500	413,175	198,995,741	26,353,607
1896	381,494	676,662	425,711	211,242,081	30,850,412
1897	412,848	721,167	444,802	237,833,984	33,451,220
1898	441,282	777,311	468,795	287,327,833	36,555,361
1899	476,194	738,286	491,174	311,547,047	40,447,909
1900	491,435	770,082	508,829	328,829,703	41,928,479
1901	529,508	806,370	516,019	269,877,426	40,950,692
1902	542,606	816,926	552,356	298,812,493	44,342,579
1903	630,590	818,307	570,262	329,475,401	47,114,730
1904	603,210	817,588	622,161	349,088,293	46,009,501
1905	698,511	884,086	654,118	378,411,754	44,048,783
1906	715,510	896,432	699,668	405,060,969	50,074,861
1907	721,120	939,321	738,210	416,101,196	60,080,014
1908	758,065	960,480	719,175	443,355,856	48,640,479
1909	851,775	1,003,243	784,109	458,424,058	49,212,004
1910	877,194	1,017,102	815,806	454,613,249	65,860,084
1911	880,098	984,946	877,697	465,414,048	63,251,731
1912	1,001,343		956,335	469,610,000	72,500,000

Our contemporary remarks that these figures are not absolutely correct, and in particular the lead figures are open to doubt, especially during the early years. The copper-production figures in the table are taken from the 'Mineral Industry' and the *Engineering and Mining Journal*. From 1873 to 1880 the lead figures are Neumann's, and as he omitted Mexico and Greece, his figures are too low. The zinc figures come from W. R. Ingalls, who has devoted much attention to this subject in his 'Production and Properties of Zinc' and in the 'Mineral Industry.' The gold and iron statistics have been collected from previous articles in the *Engineering and Mining Journal*.

Circular Shaft at New Modderfontein.—The *South African Mining Journal* for April 5 gives details of the sinking of the vertical shaft, 18 ft. inside diameter, at the New Modderfontein mine, in the far east Rand. This shaft is intended for the development of the property in depth. Sinking was started in January 1911, and the 'reef' was intersected in October 1912. The calculations were to the effect

that the 'reef' would be found at a depth from 2150 to 2300 ft., and the depth proved to be 2158 ft. The shaft was continued for another 100 ft., the total depth being 2258 ft., and the date of completion being November 16. The rate of sinking was therefore about 100 ft. per month. The cost of sinking averaged £14. 9s. 5d. per foot, and the lining by brickwork and cement £7. 12s. 2d., a total of £22 1s. 7d. per foot. The total cost of sinking and lining was £49,850, and the cost of surface equipment £30,077. At the commencement of operations, a pilot shaft was sunk through the surface strata until solid rock was reached at a depth of 71 ft. This shaft was then widened, and a concrete collar built. During these operations, the headgear and machinery required for the further sinking were erected. After the widening had been completed, the shaft was bricked and the space behind the brickwork filled with cement-grouting. On sinking below, through the rock, the sinking and lining were done alternately in short stages, to a depth of 1600 ft., and afterward the rest of the sinking was done without a break. Down to 700 ft., ordinary bricks were used for the lining, and from that level down to 2258 ft., concrete blocks, made on the surface to fit the shaft, were employed instead. Fortunately little water came into the shaft, so that the cost and trouble of bailing was a negligible quantity.

Slime Settlement.—In the *Mining and Scientific Press* for March 22, Gelasio Caetani draws attention to the effect of the viscosity of water in retarding the settlement of slime, in interfering with concentration, and in increasing the carrying-capacity of a launder. The viscosity is caused by the presence of colloidal and other matter. Mr. Caetani discusses this question in full, showing how the viscosity may be reduced by heating, and by various chemical methods. The paper does not lend itself to precis-writing; it should be read in full, as every word tells. We reproduce in the next paragraph his revised nomenclature.

Nomenclature in Ore-Dressing.—In the paper mentioned in the preceding paragraph, Gelasio Caetani gives revised definitions of the words sand, slime, and colloid, revoking his system of nomenclature published in the *Transactions* of the American Institute of Mining Engineers, Vol. 37.

There exists only one well marked division, that is, between crystalline matter and colloid. The crystalline matter includes all particles of minerals, of whatever size, that show a crystalline or granular structure; it has little or no chemical affinity with water, and its solubility under ordinary ore-dressing conditions is negligible. The word 'sand' includes all crystalline matter that is not too coarse to be treated on reciprocating-tables of the Wilfley type. Sand may be subdivided into 'coarse sand,' 'fine sand,' and 'fines.' 'Coarse sand' may be defined as including all sand that is sufficiently coarse to settle rapidly and that is not carried in suspension by water running at moderate speed. Any sand coarser than 100-mesh Mr. Caetani designates as coarse sand. 'Fine sand' will settle in a short time in still water; in water running at a moderate speed it is kept in suspension; it will all pass a 100-mesh screen, and much of it is found in the undersize of a 250 mesh screen; it can be successfully concentrated on a Wilfley table. 'Fines' includes all crystalline matter so minute that it cannot be included in the fine sand; the diameter of the smaller particles is measured in ten-thousands of an inch. At this extreme state of sub-division the crystalline matter loses many of the attributes of the coarser sand. The viscosity of water and electrostatic repulsion, in great part, or even completely, offset gravity and the partic-

les will remain in suspension for a long time. These very small particles probably have some chemical affinity with water.

A 'colloid' is an amorphous substance of gelatinous nature having a well marked chemical affinity. A colloid reacting with ammonia or caustic soda becomes soluble, forming a turbid suspension that will not settle clear. The ammonium or sodium combines with the colloid, forming very large and complex polymerized molecules in which the alkaline radical is an exceedingly small part of the whole. This is the 'sol' form of a colloid. By adding sulphuric acid to a sol, the acid combines with the sodium or ammonium base and the colloid passes into the 'gel' form, which is insoluble and precipitates. By adding barium chloride or lime to a sol, the barium or calcium displaces the sodium or ammonium, forming a new compound which is insoluble and precipitates.

Colloid particles carry also an electrostatic charge which in most cases is negative; under the influence of this charge the particles repel each other; besides this, with most clays, the negative OH ions have a marked effect in causing the colloid to assume the sol form.

The mixture of colloid and fines Mr. Caetani terms 'slime,' though, as he says, this term is usually applied to all material that will pass through a 200-mesh screen, regardless of the amount of fine sand it may contain. In some plants it is applied in a still broader sense to all material that is treated in the slime department, even if it contain some comparatively coarse sand.

Testing Lime.—The South African Engineering Standards Committee has issued Pamphlet No. 3, which contains information relating to the standardization of methods of sampling lime, and the determination of available alkalinity. In connection with the metallurgy of gold and silver, lime is used to neutralize acids contained in the ore or water, to assist in coagulating colloidal slime, and to protect cyanide from the action of 'latent' acidity. The pamphlet first describes the method of manufacturing lime, and gives instructions as to transport and handling, and then proceeds to give instructions on sampling and chemical testing.

Sampling operations should be done under cover, preferably in a shed set aside solely for this purpose. The breaking and quartering operations should be carried out on a clean solid surface that will not break or mix with the lime or have any action upon it. A good cement or steel surface will be found to meet these requirements. A wooden floor should not be used. The place where the sampling is performed should be removed from all sources of contamination by carbon dioxide and water. The operations of sampling should be done as quickly as possible to prevent undue exposure to atmospheric influences.

When sampling unslaked lump lime packed in bags, containing approximately 200 lb. each, one of the following two methods may be adopted:

(a) Where crushing machines are not available or where it is not desired to crush the lime before use, if the quantity is not less than ten tons in amount, every 20th bag is put aside. The contents are crushed until fine enough to pass through a 2 in. linear mesh sieve. The product is then mixed and quartered down three times in the usual manner, until a sample of approximately $\frac{1}{4}$ th of the original amount has been obtained. This is crushed until it is fine enough to pass through a sieve of $\frac{1}{2}$ in. linear mesh, and the product again mixed and quartered down three times until a sample of approximately $\frac{1}{64}$ th of the original amount (or $\frac{1}{16}$ th

of the amount obtained after quartering three times) has been obtained. This product is crushed until it passes completely through a 30 mesh sieve and reduced by successive quartering until a sample of about 3 to 4 lb. weight is obtained, which is spread out evenly on a clean surface. By dipping at regular intervals over the whole surface three amounts sufficient to fill three 4-oz. bottles completely are obtained. Tightly fitting stoppers are then inserted. If the original consignment is less than 10 tons in amount the sample must be taken in the same proportion, namely, not less than 5% of the whole, and at regular intervals over the whole consignment.

(b) Where suitable crushing machinery, such as a ball mill, is available, the bags, selected as in (a) above, are emptied into the crusher, and as the contents discharge, portions are taken with a shovel or scoop at regular intervals. The portions thus abstracted must not be less than 2% in weight of the sample crushed, a minimum of 20 portions being taken. These are thoroughly mixed on a suitable floor and quartered down until a sample of 3 to 4 lb. is obtained, which is then treated as in method (a).

In cases where the lime is delivered in a crushed state, bags are taken at regular intervals such that the sample obtained represents about 5% of the whole consignment. Each bag is dealt with as follows. The contents are emptied on a clean floor and thoroughly mixed as quickly as possible, and, after mixing, a large shovelful is taken and set aside. The portions thus obtained from each bag are thoroughly mixed and quartered down until the final portion weighs approximately 3 to 4 lb., which is then treated as in (a).

The operations in connection with slaked lime are the same as given for crushed lime.

It is to be noted that the final samples of about 4 oz. weight should be enclosed in bottles with tightly fitting dry stoppers, or in such other receptacles as will entirely prevent admission of air. Before transmission for analysis, the receptacles must be sealed and securely packed in such a manner that the sample may not be injured in any way during transit.

In the determination of 'available alkalinity,' that is, CaO, the sample as delivered for analysis is contained in an air-tight vessel, having been passed through a 30 mesh sieve as stated above. It is crushed with a Wedgwood mortar and pestle, and the whole passed through a 60-mesh sieve, this operation being performed as quickly as possible. It is then placed in a clean, dry, wide-mouthed bottle fitted with a tight fitting dry glass stopper so as to prevent any access of air. Two grams of this is carefully weighed and agitated with 1 litre of a 2% cane sugar solution (or 1 gram with $\frac{1}{2}$ litre of 2% sugar solution). If a shaking machine be available, 2 hours' continuous agitation should be given, if not, 6 hours' intermittent agitation, every care being taken to prevent coagulation of the lime, in order that the lime and solution may be brought into the most intimate contact during this period. When the agitation is finished the solution is filtered as quickly as possible, and aliquot portions titrated with N/10 or N/5 acid, using rosolic acid as indicator, avoiding delay so as to obviate undue exposure to the atmosphere. The distilled water used in the above determination must be made neutral to rosolic acid to counteract the presence of dissolved carbonic acid gas.

Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to *The Mining Magazine*.

CURRENT LITERATURE.

Reinforced Concrete for Mines.—At the March meeting of the London Concrete Institute, S. M. Dixon read a paper giving the results of tests on beams and props made of reinforced concrete, intended for use as mine supports.

Electric versus Compressed-Air Hoists.—In the *Engineering and Mining Journal* for March 29, K. A. Pauly replies to B. V. Nordberg's article in the issue of May 18, 1912. Mr. Nordberg is the exponent of the compressed-air system of hoisting, and Mr. Pauly presents the case for electric hoisting.

Testing Placers.—In the *Engineering and Mining Journal* for April 5, W. I. Ward describes a drilling outfit for testing placers in Colombia, being a combination of the Empire and Keystone systems.

Excluding Water from Oil Wells.—Technical Paper No. 32, published by the United States Bureau of Mines, describes the cementing process for excluding water from oil wells as practised in California, the authors being Ralph Arnold and V. K. Garfias.

Errors in Sampling.—At the April meeting of the Institution of Mining and Metallurgy, a paper by Franklin White was read, and discussed, entitled 'Errors in Sampling and Assaying Ores due to the Presence of Coarse Gold.'

Oxidizers in Cyanide Reactions.—The February issue of the *Journal of the Chemical, Metallurgical, and Mining Society of South Africa*, contains a paper by Morris Green, discussing some aspects of the work of oxidizers in connection with cyanide solutions, and details results obtained by him, under certain conditions, with ferrioxamide.

Rosario, Honduras.—In the *Mining and Scientific Press* for March 29, R. B. Rogers describes the building of a mill and cyanide plant at the Rosario gold mine at San Juancito, Honduras.

Gold-Mining in Korea.—In the *Mining and Scientific Press* for April 5, J. D. Hubbard describes the metallurgical plant now in course of erection at the gold mine of the Chosen Mining Co., in Korea.

Sampling in Metallurgical Plant.—In the *Mining and Scientific Press* for April 5, Donald F. Irvin describes current practice in sampling at a plant (name not given) where hand-sorting, concentration, and cyaniding are employed.

Cyaniding at Nevada Wonder.—In the *Engineering and Mining Journal* for April 5, Herbert A. Megraw describes the cyanide plant at the Nevada Wonder mine, where the ore is all-slimed in stamps, Chile mills, and tube mills.

Slime-Settlement.—The *Proceedings of the Australasian Institute of Mining Engineers* for December contains a paper on slime-settlement, by W. Shell-shear. He reviews the work done by other investigators, and gives the results of his own researches. Some of his results did not confirm those of previous writers, the main one being in connection with Broken Hill slime, which settles at the same rate whatever the dilution.

Analysis of Zinc Dust.—In the *Engineering and Mining Journal* for April 19, J. E. Clennell gives particulars of his experience in connection with the analysis of zinc dust used in the precipitation of gold from cyanide solutions.

Copper Mines in Chile.—In the *Mining and Scientific Press* for March 29, Juan Blanquiere commences an article on the copper production of Chile and on the principal mines.

Charging Blast-Furnaces.—In the *Mining and Scientific Press* for March 22, C. W. Renwick de-

scribes the latest form of machine invented by W. H. Freeland and used at the Ducktown pyritic smelting-furnace. The machine traverses from side to side, and end to end, so as to distribute the charge evenly.

Chromiferous Iron Ores in Greece.—At the May meeting of the Iron and Steel Institute, Herbert K. Scott described the deposits of iron ores in Greece containing small proportions of chromium, as well as nickel and cobalt. These ores are imported into England, and mixed with other ores for the production of pig iron, the chromium being considered an impurity that has to be eliminated. Similar ores from Cuba are now treated in the United States for the production of special pig iron and steel, and the author urges that the treatment of Greek ores should follow similar lines.

Bulgarian Mineral Deposits.—At the April meeting of the Institution of Mining and Metallurgy, Herbert K. Scott presented a paper describing some Bulgarian mineral deposits, including coal, lignite, manganese, magnetic iron, copper, zinc, and lead. The chief copper producer is the Plakalnitza, near the station of Elisena, on the Sofia—Vratza line. The ore consists of various sulphides and malachite distributed in lenses through a dolomitic limestone of Triassic age. In depth galena makes its appearance. A smelting furnace is erected, and the matte shipped.

Tasmanian Tin.—The *Proceedings* of the Australasian Institute of Mining Engineers for December contains a paper by Malcolm S. Moore, on the Blue Tier tin district in the northeast of Tasmania. This district is of interest in England as it contains the property of the Anchor Tin Mining Company.

Central Africa.—In the *Mining and Scientific Press* for April 12, S. H. Ball and M. K. Shaler give an account of transportation facilities in Central Africa, especially in connection with Belgian Congo.

Synthetic Ammonia.—*Metallurgical and Chemical Engineering* for April contains a translation of the report by F. Haber and R. Le Rossignol on their experiments in connection with the commercial production of synthetic ammonia. The Badische Anilin & Soda Fabrik, Germany, is erecting a plant on this system. The mixture of nitrogen and hydrogen gases is passed over a catalyser, such as osmium, at a temperature of 500 to 700° C, and at a pressure up to 100 atmospheres; a portion of the gases enters into combination as ammonia, and on the subsequent passage of the gases through a refrigerator, the ammonia is separated as a liquid. This process is to be made the basis of a fertilizer industry.

BOOKS REVIEWED

A Text-Book of Mining Geology. By James Park. Third edition, revised and enlarged. Cloth, octavo, 320 pages with many illustrations. London: Charles Griffin & Co. Price 6s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is one of the most useful of technical books. Published first in 1906, then in 1907, and last in 1911, it has been kept up-to-date with a painstaking care characteristic of the author in all his work. Mr. James Park is professor of mining in the University of Otago and director of the Otago School of Mines. He has long been identified with the economic application of geology in New Zealand, and was peculiarly fitted to prepare the comprehensive text-book under review. The scope of it is wide indeed. An introductory chapter deals with the elements of geology. The second is devoted to a classification of ore deposits, with a great variety of examples, with simple illustra-

tions. The author is particularly good in his treatment of alluvial deposits, which are apt to be slighted by most writers on mining. New Zealand, of course, affords excellent material for the purpose, but Mr. Park has borrowed illustrations from Victoria, California, and the Yukon. His classification of ore deposits is morphological; and this is perhaps the best basis for the purpose of exploratory work, for it emphasizes structure rather than origin, and to the miner the structural features are the most readily evident and the most immediately important. Veins are given a chapter to themselves. Under this heading are discussed the origin, structure, and mineralization of the dominant types of ore deposit. Secondary enrichment and persistence of ore are explained simply. A large quantity of pertinent information is condensed within a few pages, the selection of facts being made with admirable good sense. In the next chapter the student is given a clear analysis of faults and faulting, illustrated by a select bibliography, of the greatest convenience to an inquiring reader. In Chapter VII we find the outlines of economic mineralogy, informing the student concerning the principal ores of the metals, with sufficient reference to their geographic distribution. The commercial non-metallic minerals, such as oil, mica, gypsum, and graphite are included. The last two chapters deal with the sampling and valuation of mines, giving the simple calculations required for ordinary cases of dislocation. Chapters V and VI are devoted to theories of ore deposition. It is a difficult subject for a small text-book, but Mr. Park has used discretion, so that the reader is only given the essentials. Here, as in other parts of the book, we find the author giving references to the literature of the subject with a scholarly amplitude and precision highly commendable. Indeed, his foot-notes furnish in a few pages a large number of invaluable hints, illustrated by practical examples. And when the reader comes to the last of the 300 pages he may well conclude that this modest little text-book contains the sifted information ordinarily scattered in a library of technical writings. If adverse criticism be made, it is on the score of terminology, which hankers too much toward local usage. 'Reef-bottom,' 'pay-wash,' 'the best gold,' and the like are the words of illiterate persons in New Zealand or Australia. They only disfigure a book that is intended to be read wherever the English language is spoken. However, others may not notice them as much as the reviewer, and, in any case, they constitute a minor blemish upon an honest piece of book-making. We commend this publication confidently to the student and mining engineer. To the latter it affords a convenient means of carrying in his pocket a little library of useful information.

T. A. R.

The Mining World Index of Current Literature. Vol. 2. By George E. Sisley. Cloth, octavo, 240 pages. Chicago: *The Mining & Engineering World*. Price 8s. 6d. net.

We have from time to time reviewed many books that have as their object the classification and indexing of current literature. It is the laudable ambition of every journalist to perform this valuable service, for his own instruction as well as for the benefit of his circle of readers. Our Chicago contemporary has recently embarked on this enterprise, and provides a weekly index to a wide range of publications. These are reprinted in half-yearly volumes. The first appeared in August last, and the second, covering the months July to December, has just been received. We wish to compliment the editor on his appreciation of

the fact that editorials are of as great importance as signed articles. As most indexes ignore the editorial expression of opinions and presentation of information, the intelligent appreciation of the situation by Mr. Sisley deserves special mention.

Modern Pumping and Hydraulic Machinery. By Edward Butler. Cloth, octavo, 480 pages, with 345 illustrations. London: Charles Griffin & Co. Price 18s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

The applications of water power and water pumps are so various that it is difficult to enter into details of all of them within the pages of even so large a book as Mr. Butler's, especially when so great a proportion of the space is occupied with drawings. We congratulate the author on doing so well. Pumps of all types are described, for all applications, driven by steam, gas, and electricity; turbines, water-wheels, suction pumps for dredges, pumps for corrosive liquids, the air-lift, hydraulic transmission of power; boring appliances for wells, both water and oil; valves of all sorts, injectors; etc. The theoretical principles are explained and the relative advantages are discussed. Engineers will find the book of value for all purposes of reference, though their researches would be facilitated if the author had provided a better index.

Treatment of Concentrate at the Goldfield Consolidated Mill. By J. W. Hutchinson. Pamphlet, 16 pages, illustrated. San Francisco: *Mining and Scientific Press*; London: *The Mining Magazine*. Price one shilling.

In the summer of 1911, a series of articles by J. W. Hutchinson was published in the *Mining and Scientific Press*, describing the metallurgical practice at the Goldfield Consolidated, Nevada. Since then, important modifications have been made in the method of treating the concentrate, and particulars were given by Mr. Hutchinson in an article that appeared in the issues of January 25 and February 1 of this year. The new method consists of a combination of cyaniding raw and roasted concentrate. The rich concentrate coming from the Deister tables is cyanided raw, whereby an extraction of 85% of the gold is obtained, leaving gold worth \$25 in each ton of tailing. The tailing is then dried, roasted, washed for copper, and cyanided. Mr. Hutchinson gives the reasons for the adoption of this method, and full details of the process. These articles are now reprinted in pamphlet form and constitute a valuable addition to the literature of gold metallurgy.

Pyrites in Canada. By Alfred W. G. Wilson. Paper covers, octavo, 210 pages, with maps and illustrations. Ottawa: Government Printing Bureau. Price 6s. For sale at the Technical Bookshop of *The Mining Magazine*.

This is another of the admirable series of technological handbooks inaugurated by Eugene Haanel, and issued by the Canadian Department of Mines. There is a demand for pyrite in Canada and also in the Lake region of the United States, for use in the manufacture of sulphuric acid and sulphurous acid, the latter being required in the wood-pulp industry. Most of the sulphurous acid used in Canada is at present made from imported sulphur. The object of Mr. Wilson's book is to help the Canadian owners of pyrite properties in concentrating and marketing their ores, and to make available in a convenient form the information required in roasting pyrite and applying the products. The headings of the chapters indicate the ground covered, sulphur and its compounds, mining and marketing pyrite; statistics of sulphur and pyrite pro-

duction, occurrence of pyrite in Canada and other countries, the roasting of pyrite, manufacture of sulphuric acid, sulphite pulp industry. The chapter on roasting is excellent, for it gives detailed drawings of all the types of roasting furnaces, and shows their application for this particular purpose.

A Manual of Petrology. By F. P. Mennell. Cloth, octavo, 260 pages, with many illustrations. London: Chapman & Hall. Price 7s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is a new edition of the author's 'Introduction to Petrology,' which we reviewed two years ago, with many re-arrangements and additions. Mr. Mennell is an authority on Rhodesian geology, and he has contributed many articles to the geological journals and transactions. The book contains many references to Rhodesian and other South African occurrences of rocks, minerals, and ores, so much so as to give it a distinctive character. Moreover, the information and views are founded largely on his own observations.

Geology and Mining Industry of the Kinta District, Federated Malay States. By J. B. Scrivenor. Octavo, paper boards, 90 pages, with many illustrations. Kuala Lumpur: The Government Printing Office. Price three dollars.

This is by far the most important work ever published on the geology of the Kinta tin district, in the State of Perak. The author, J. B. Scrivenor, government geologist for the Federated Malay States, presents an entirely new view of the geology of the district, and his conclusions should be read by everybody interested in tin deposits. We give some extracts in the 'Précis of Technology.'

Tin-Mining Handbook. By Hubert A. Meredith. Pocket size, paper boards, 250 pages. London: *The Financial Times*. Price 2s. 6d. net. For sale at the Technical Bookshop of *The Mining Magazine*.

It is about a year ago since Mr. Meredith commenced the publication of a small handbook relating to tin, but as it was published on private account, it did not become as generally known as it deserved. The book has now been greatly enlarged, and it is published by *The Financial Times*, so we expect its vogue will be notably extended. An introductory chapter reviews conditions in Cornwall, Nigeria, Malaya, and Bolivia, and the remainder of the book gives details of all the tin-mining companies known in England.

Oil and Petroleum Manual for 1913. By Walter R. Skinner. Cloth, octavo, 250 pages. London: W. R. Skinner. Price 4s. net. For sale at the Technical Bookshop of *The Mining Magazine*.

This is the fourth annual issue of a useful reference book. It contains particulars of over 760 companies interested in oil and petroleum, with the names of directors, engineers, etc.

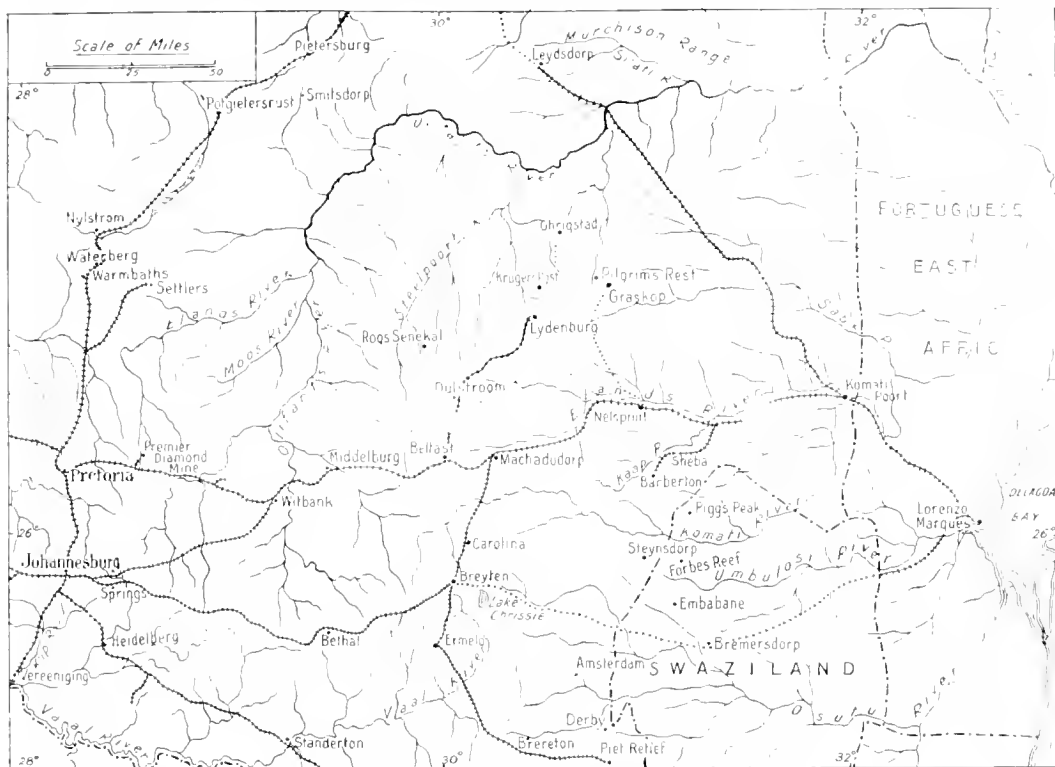
Everyday Uses of Portland Cement. Cloth, octavo, 360 pages, illustrated. London: The Associated Portland Cement Manufacturers, Limited. Price 2s. 6d. For sale at the Technical Bookshop of *The Mining Magazine*.

This is the third edition of a book that has had a wide circulation. It gives valuable practical information relating to the application of cement to concrete construction, and it is therefore of use to the mining engineer, who is now required to know all about concrete shafts, supports, etc.

COMPANY REPORTS

Worcester Exploration & Gold.—This company was formed under the laws of the Cape Province in 1887 to acquire a small property on the Rand outcrop, between Robinson and Ferreira. Substantial profits were made for eleven years, and then the company sold the mine for £90,000 cash to the Ferreira. Subsequently the Kentish and Bonnie Dundee claims, 16 miles north of Barberton, were bought. The development here warranted the erection of a mill of 40 stamps, together with cyanide plant. More recently 2 tube-mills have been added. Satisfactory profits have been made continuously on comparatively low grade ore, but during the last two years the scarcity of labour has interfered with regular work. During

New Lisbon-Berlyn.—This company was formed in 1885 to work gold mines in the Pilgrim's Rest district of the Transvaal. It has been re-constructed five times, the last occasion being when the control passed into the hands of the Ehrlich group in 1906. On previous occasions we have recorded how the old properties were abandoned, and that operations are now centred on the Frankfort property. Profits were earned two years ago on the oxidized ore, but little is left of this class, and future operations will have to be devoted to the pyritic ore. At the present time, Harold Sharpley is experimenting on this ore with the object of finding the best method of treatment. The report for the year ended September 30, 1912, shows that 22,701 tons of oxidized ore was treated, yielding 6448 oz. gold, worth £27,407, at a cost of £22,354. The supply of



EASTERN PORTION OF THE TRANSVAAL.

the year 1912, the amount of ore raised was 59,293 tons, and the yield by amalgamation and cyanide was 14,868 oz., worth £62,989, or 21s. 3d. per ton. The working profit was £16,851, or 5s. 8d. per ton, and the shareholders received £16,751, the dividend being at the rate of 17½%. Out of capital account, £16,149 has been spent on the construction of a hydro electric power plant at Cataract Falls, on the northern branch of the Kaap river. The plant started in September, and it is hoped by its means to reduce the cost of power as compared with that of the gas plant at present in use. The scanty rainfall has curtailed the amount of water flowing to the plant, but the figure for the rainfall for 1912, namely 16 inches, is much below the average, and compares with 33½ inches in 1911. The ore reserve on December 31 was estimated at 110,000 tons, being an increase of 17,000 tons during the year.

oxidized ore is being rapidly exhausted. The high price of fuel is inimical to an economical roasting of the pyritic ore, as the fuel has to be brought 40 miles by wagon from Lydenburg. It is expected that the railway to Pilgrim's Rest will be completed shortly, when the wagon transport will be reduced to 10 miles. Mr. Sharpley is now sampling the pyritic ore. If the reserve and the method of treatment prove satisfactory, the H. E. Proprietary and the New Districts Development Co., belonging to the same group, will provide such further working capital as is necessary.

City & Suburban.—This company was formed in 1887 under Natal laws to acquire an outcrop mine in the central part of the Rand. The technical control is with the Central Mining & Investment Corporation. Milling commenced in 1891. The report for 1912 shows that 367,368 tons of ore was raised, and after the removal of 12% waste, 323,934 tons, averaging

38s. 3d. per ton, was sent to the mill. The yield by amalgamation was 99,010 oz., and by cyanide 43,263 oz., a total of 142,273 oz., worth £622,847, or 38s. 5d. per ton milled. The working cost was £350,511, or 21s. 7d. per ton, leaving a working profit of £272,335, or 16s. 9d. per ton. In addition, a profit of £4,257 was made by the treatment of accumulated tailing. Profits tax absorbed £22,653, and £204,000 was distributed as dividend, being at the rate of 15%. The ore reserve on December 31 was estimated at 773,300 tons, averaging 8.4 dwt. Developments continue to expose ore of satisfactory quality. Judging by claim-area, the life of the mine may be taken at six years.

New Heriot Gold.—This company was formed in 1887 under Natal laws, to acquire a small property on the outcrop in the eastern part of the central Rand, between Nourse and Jumpers. The office is at Pietermaritzburg. The company belongs to the same group as the City & Suburban, though the technical control is in the hands of the Central Mining & Investment Corporation. During the year 1912, the ore raised was 162,131 tons, and after the rejection of 15% waste, 137,680 tons, averaging 38s. 1d. per ton, was sent to the 70-stamp mill. The yield by amalgamation was 43,345 oz., and by cyanide 17,487 oz., a total of 60,832 oz., worth £255,509, or 37s. 1d. per ton. The working cost was £151,222, or 21s. 11d. per ton, leaving a working profit of £104,287, or 15s. 2d. per ton. In addition, a profit of £6463 was made from the treatment of 18,334 tons of accumulated tailing. Development work during the year exposed 109,822 tons, averaging 7.9 dwt. per ton, and the reserve on December 31 was estimated at 590,742 tons, averaging 8.1 dwt. Based on claim-area, the expected life of the mine is seven years.

Robinson Gold.—This company, owning the star mine of the Rand, has for the past two years been making less profit, and the end of operations will come in a few years. The directors are accumulating a fund out of profits to be devoted to the perpetuation of the enterprise. The nature of the proposal is not divulged, but probably it will be similar to the method adopted in connection with other mines in the Central Mining group, that is to say, the funds will be invested in shares in an adjoining deep level, in this case the Crown Mines. The report for 1912 shows that 673,058 tons of ore was raised, and after the rejection of 14% waste, 579,950 tons was sent to the mill. These figures were 37,000 tons and 15,400 tons less than in 1911 respectively. The yield was 300,365 oz., as compared with 320,592 oz., being 43s. 8d. per ton as compared with 45s. 5d. The revenue was £1,260,529, and the working cost £451,760, or 15s. 8d. per ton, leaving a profit of £808,760, or 28s. per ton. The ore reserve on December 31 was estimated at 1,373,100 tons in the Main Reef Leader and South Reef, these containing the ore of high grade, and 1,160,080 tons in the Main Reef, of lower grade. The development work done during the year disclosed ore assaying as follows: in the Main Reef Leader, 60s. over a width of 36 in.; in the South Reef, 220s. over 15 in.; and in the Main Reef 26s. 8d. over 34 in. Out of the profit for the year, £46,576 was paid in connection with undermining rights, and £64,639 as profits tax. The shareholders received £618,750, being at the rate of 22½%, while £88,000 was added to the balance in hand, which now stands at £348,996. The table of results since the commencement, attached to the report, shows that 5,971,075 tons has been milled and 4,115,137 fine ounces recovered, being at the rate of 13.75 dwt. per ton. During the first year, 1888, the yield per ton was 59 dwt., the next year it was

40 dwt., and for several years thereafter over 20 dwt. The figure has steadily decreased until now it is 9.6 dwt. The working cost per ton was 57s. the first year, and was gradually lowered until 1910, when it was 12s. 2d. But since then it has advanced once more, on account chiefly of the inefficiency of labour.

Geldenhuis Deep.—This company belongs to the Rand Mines group, and was formed in 1909 as an amalgamation of the Geldenhuis Estate, Geldenhuis Deep, and Jumpers Deep. The Geldenhuis Estate was the second mine started on the Rand, and milling commenced in 1887. The Geldenhuis Deep started operations in 1895, and the Jumpers Deep in 1898. The total number of stamps owned by the consolidated company is 420, and there are 7 tube-mills. For the past two years the development has given disappointing results, in spite of extra amount of work done in this direction. The report for 1912 shows that 776,511 tons of ore was raised, and that after the rejection of 19% waste, 628,210 tons was sent to the mill, averaging 31s. 4d. per ton. The number of stamps running was 300. The yield by amalgamation was 153,730 oz., and by cyanide 71,787 oz., a total of 225,517 oz., worth £946,154, or 30s. 2d. per ton. The working cost was £811,301, or 25s. 10d. per ton. The revenue was 2s. 5d. per ton higher than in 1911, and the cost 3s. 9d. higher. The working profit was £134,853, or 4s. 4d. per ton. Out of the profit, £22,633 was spent on capital account on plant, £9290 was paid as profits tax, and £87,862 was distributed as dividend, being at the rate of 15%. The tonnage milled during the year was 173,900 less than in 1911. Owing to the exhaustion of the north section, the north mill was stopped in January 1912. Scarcity of labour interfered with mining and development. During the year, 29,459 ft. of development was done, exposing 433,410 tons of ore averaging 6.9 dwt. The reserve on December 31 was estimated at 1,904,700 tons, averaging 6.3 dwt. The cost was increased by the expense involved in packing the stopes underneath the government railway. Since the close of the year under review, the conditions have improved and the cost reduced. In March 1912, H. Musson Thomas resigned as manager, and was succeeded by Paul Selby. During the latter's leave of absence, Edgar Pam has been in charge.

City Deep.—This company, belonging to the Rand Mines group, owns a property in the central Rand, below the City & Suburban, Meyer & Charlton, Wolhuter, and New Goch. Though the company was registered in 1899, it was only in 1908, when the properties of a number of other companies were absorbed and consolidated, that active development was commenced. A plant containing 200 stamps and 9 tube-mills was built, and two shafts sunk. Milling started in 1910, but underground development was not sufficiently advanced to make it possible to supply ore for the capacity of the mill, 65,000 tons per month. The report for 1912 shows that though the output has been greatly increased, it is still 33% less than the calculated maximum, owing largely to the short supply of native labour. During the year, 487,565 tons of ore was raised, and 81,228 tons taken from the dumps, and after the rejection of 15% waste, 479,630 tons was sent to the mill, in which 120 out of the 200 stamps were running. The assay-value of the ore fed to the mill was 35s. 9d. The stamp duty was 13.6 tons per day. The yield by amalgamation was 132,763 oz., and by cyanide 70,256 oz., a total of 203,019 oz., worth £852,039, or 35s. 6d. per ton. The working cost was £569,621, or 23s. 9d. per ton, leaving a working profit of £282,418, or 11s. 9d. per ton. Out of the profit, the first dividend distributed by the company absorbed

£156,250, being at the rate of 12½%. In addition, £23,928 was spent on capital account, £26,870 paid as profits tax, and the remainder carried forward. The ore reserve on December 31 was calculated at 2,123,650 tons, averaging 8.7 dwt., or 36s. 6d. per ton. This is practically all in the Main Reef Leader. Developments during the year have been highly gratifying. The cost per ton is high, but is explained by the fact that the mine is not yet being worked on the scale calculated, and also because the figure, 3s. 9d., for development redemption is exceptional. Only the labour question prevents the output and profit being as good as they should be.

Village Deep.—This company belongs to the Rand Mines group, and owns a deep level property in the central part of the Rand. The report for 1912 shows that by raising the minimum for the gold content per ton of ore mined, and by narrowing the stopping width on the Main Reef Leader, the average yield per ton milled has been increased by 3s. 4d., to 29s. 10d. At the same time the cost increased by 1s. 4d. per ton, leaving a net increase in profit of 2s. per ton. The amount of ore raised was 698,124 tons, and after the rejection of 14% waste, 596,900 tons was sent to the mill, as compared with 569,500 tons during 1911. The average content of the mill ore was 30s. 8d. The yield by amalgamation was 149,336 oz. and by cyanide 62,773 oz., a total of 212,109 oz., worth £889,246, or 29s. 10d. per ton. The working cost was £594,436, or 19s. 11d. per ton, leaving a working profit of £294,809, or 9s. 11d. per ton. Out of the profit, £42,427 was spent on capital account, chiefly for plant and shaft equipment; £25,101 was paid as profits tax, and £185,617 distributed as dividend, being at the rate of 17½%. The ore reserve was estimated on December 31 at 2,235,300 tons, averaging 6.9 dwt., or 29s. per ton. H. Stuart Martin is consulting engineer, and J. Whitehouse manager.

Modderfontein B.—This company was formed by the Rand Mines group in 1908 to acquire a gold-mining property in the far east Rand, being an easterly extension of the New Modder property. There is no outcrop, as the Witwatersrand series is buried beneath more recent deposits. The dip of the 'reef' is not more than 14°. Development has been done by coal-mining methods, and mechanical haulage has been adopted, thus greatly decreasing the number of natives required. The 'reef' is from 7 to 12 in. thick and assays from 1½ to 2 oz. The stopping width is 50 inches. Milling with 80 stamps and 5 tube-mills commenced in September 1911. The report now published covers the year 1912, and the year's work was notable for the earning of the first dividend. The tonnage raised from the mine was 437,306 tons, and after the removal of 11% waste, 388,570 tons averaging 39s. 2d. per ton was sent to the mill. The yield by amalgamation and cyanide was 172,838 oz., worth £725,219, being a recovery of 37s. 4d. per ton milled. The working cost was £343,066 or 17s. 8d. per ton, and the working profit £382,153 or 19s. 8d. per ton. The cost was steadily reduced throughout the year, and during the last quarter was 16s. 5d. per ton milled. Out of the profit, £71,060 was used for paying the excess cost of development and equipment over the sum provided out of capital. £38,958 was paid as profits tax, £140,000 was distributed among shareholders, being at the rate of 20%, and £123,434 carried forward. The ore reserve on December 31 was estimated at 2,594,000 tons, averaging 7.2 dwt. or 30s. 3d. per ton. Judging by claim-area, the ultimate resources may be guessed at 8 or 10 times as much. Sorting is done underground, and the waste used for rock-walling. This practice ex-

plains the fact that the assay-value of the ore raised, and before sorting above ground, is higher than the average of the mine.

Rose Deep.—This company belongs to the Rand Mines group and owns a property in the middle east Rand, on the dip of the Primrose, May, and Glencairn. In 1909 the adjoining Glen Deep was absorbed, and the two properties worked as one. The combined plants contain 300 stamps and 7 tube-mills. During 1910 serious trouble was experienced owing to caving in the upper levels, and the hoisting shaft was rendered unsafe. Subsequently labour shortage interfered with operations. The report for 1912 shows that all these troubles have been overcome, the output has increased, and the cost decreased. The amount of ore raised from the mine was 922,844 tons, and after the rejection of 15% waste, 782,200 tons, averaging 29s. 9d. per ton, was sent to the stamps. The recovery by amalgamation was 178,509 oz., and by cyanide 90,101 oz., a total of 268,610 oz., worth £1,128,127, or 28s. 10d. per ton. The working cost was £681,303, or 17s. 5d. per ton, leaving a profit of £446,823, or 11s. 5d. per ton. Out of this, £36,535 was appropriated to capital expenditure, £36,465 was paid as profits tax, and £315,000 was distributed as dividend, being at the rate of 45%. As compared with 1911, the yield per ton was 11d. higher, the cost per ton 6d. lower, and the dividend £35,000 more. The ore reserve on December 31 was estimated at 3,695,100 tons, averaging 6.1 dwt., or 25s. 7d. per ton. B. Madew, the consulting engineer, reports that the mine is in excellent condition and the prospects bright.

Bantjes Consolidated.—This company, belonging to the Rand Mines group, owns a property on the outcrop of the middle west Rand. Some milling was done in 1888, but the results were discouraging, and it was only in 1908 that systematic development was undertaken. A mill containing 100 stamps and 3 tube-mills started operations in the latter half of 1910; and the first dividend was earned in 1912. The report for 1912 shows that 327,710 tons of ore was raised, and after the rejection of 12½% waste, 286,553 tons averaging 30s. 8d. per ton was sent to the mill. The yield by amalgamation and cyanide was 101,076 oz., worth £423,021, or 29s. 6d. per ton. This figure is 2s. per ton higher than in 1911, the reason being that no dump ore was treated in 1912. The working cost was £345,275 or 24s. 1d. per ton, leaving a working profit of £77,746 or 5s. 5d. per ton. Out of the profit, £6899 was paid as profits tax, and £56,509 distributed as dividend, being at the rate of 11¼%. The ore reserve on December 31 stood at 840,800 tons averaging 7 dwt., and there are also large blocks of ground of debatable profitability. Development during the past year has been centred on shaft-sinking and other preliminary work required for an energetic development campaign, so that the reserve was not maintained. During the present year and 1914 the expectations are that the reserve will be greatly increased. The largest proportion of the ore comes from the South Reef.

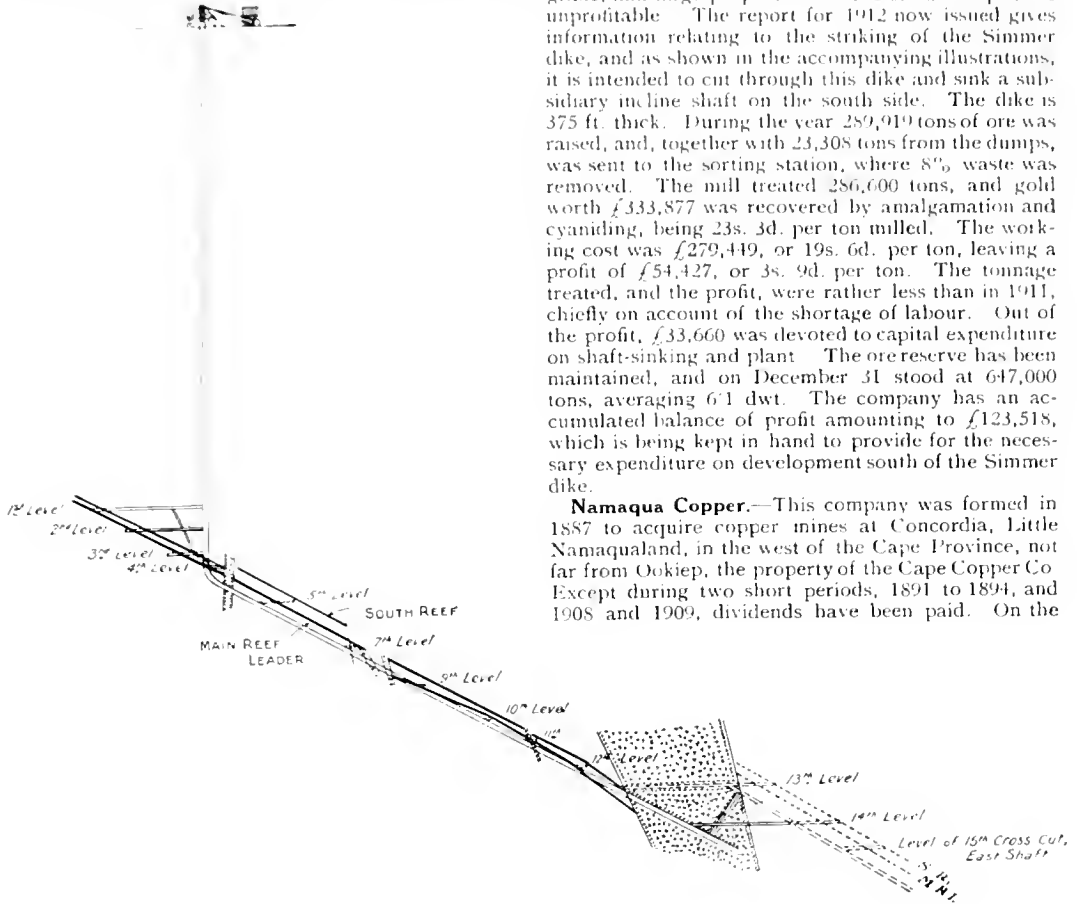
New Kleinfontein.—This company belongs to the Anglo-French group, and was formed in 1893 to acquire an outcrop property in the far east Rand. Edward J. Way is the consulting engineer, and R. M. Torn is manager. For some years Mr. Way stood out against the tube-mill, but installed 4 in May 1912. At that time it was desired to increase the milling capacity, and as there was no suitable accommodation on the site for additional stamps, the tube-mills were adopted. In the report for 1912, Mr. Way states that the cost of treatment has not been decreased, nor has

the percentage of recovery been increased, since the tubes were erected. During the year, 692,722 tons of ore was raised, and after the rejection of 21% waste, 549,730 tons, averaging 7.2 dwt., was sent to the mill. The yield by amalgamation was 121,407 oz., and by cyanide 60,318 oz., making a total of 181,725 oz., worth £785,338, being a recovery of 6.7 dwt., or 28s. 6d. per ton milled. The working cost was £535,054 or 19s. 5d. per ton, leaving a profit of £240,653 or 8s. 9d. per ton. Out of the profit £16,734 was paid as profits tax, £8326 was paid as interest, £77,728 was devoted to capital expenditure on shaft sinking and plant, and

of a number of unexpected dikes has been discovered, and for this reason the amount of ore per claim will be less. Consequently the life of the mine is given as 13 years instead of 16. The development during the year increased the ore reserve by 91,215 tons, and the total on December 31 was estimated at 1,190,663 milling tons, averaging 7.59 dwt. per ton.

Knight Central. This company belongs to the Neumann group and was formed in 1895 to acquire a second deep in the middle east Rand. The plant, which consists of 120 stamps and 3 tube-mills, was started in 1909. The ore is of comparatively low grade, and large proportions of the ore developed are unprofitable. The report for 1912 now issued gives information relating to the striking of the Simmer dike, and as shown in the accompanying illustrations, it is intended to cut through this dike and sink a subsidiary incline shaft on the south side. The dike is 375 ft. thick. During the year 289,919 tons of ore was raised, and, together with 23,308 tons from the dumps, was sent to the sorting station, where 8% waste was removed. The mill treated 286,600 tons, and gold worth £333,877 was recovered by amalgamation and cyaniding, being 23s. 3d. per ton milled. The working cost was £279,449, or 19s. 6d. per ton, leaving a profit of £54,427, or 3s. 9d. per ton. The tonnage treated, and the profit, were rather less than in 1911, chiefly on account of the shortage of labour. Out of the profit, £33,660 was devoted to capital expenditure on shaft-sinking and plant. The ore reserve has been maintained, and on December 31 stood at 647,000 tons, averaging 6.1 dwt. The company has an accumulated balance of profit amounting to £123,518, which is being kept in hand to provide for the necessary expenditure on development south of the Simmer dike.

Namaqua Copper.—This company was formed in 1887 to acquire copper mines at Concordia, Little Namaqualand, in the west of the Cape Province, not far from Ookiep, the property of the Cape Copper Co. Except during two short periods, 1891 to 1894, and 1908 and 1909, dividends have been paid. On the



VERTICAL SECTION OF KNIGHT CENTRAL, THROUGH No. 2 SHAFT.

£121,250 was distributed as dividend, being at the rate of 12½%. The item of interest relates to the loan of £174,000 obtained from the bank in 1910 for the purpose of developing the new Orient ground on the New Modder border. Attempts have been made to liquidate this debt by an issue of shares or debentures, but without avail, so the board has decided to set aside a larger proportion of profit and so extinguish the debt within a few years. Thus the dividend for 1912 was fixed at 12½%, instead of 15%, as originally intended. Owing to the disappearance of the Main Reef Leader and the Upper Main Reef in the western part, it has been necessary to reduce the forecast of the ultimate life of the mine. In the eastern section, the presence

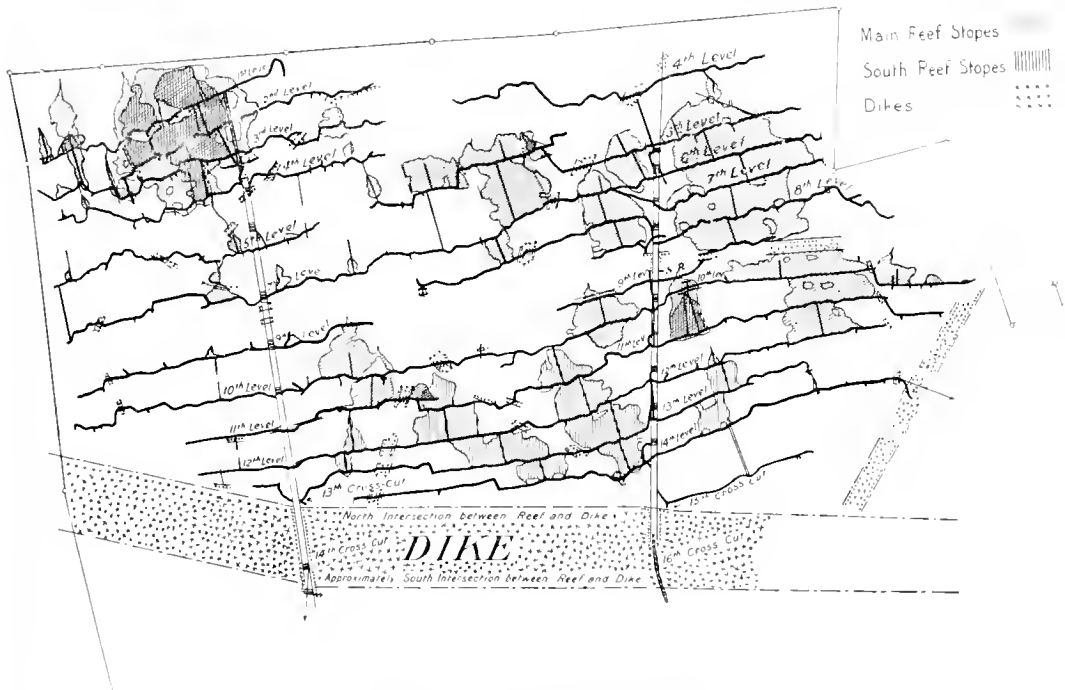
of a number of unexpected dikes has been discovered, and for this reason the amount of ore per claim will be less. Consequently the life of the mine is given as 13 years instead of 16. The development during the year increased the ore reserve by 91,215 tons, and the total on December 31 was estimated at 1,190,663 milling tons, averaging 7.59 dwt. per ton. The developments during the year con-

tinued to expose ore, and the reserve on December 31 was estimated at 99,598 tons, averaging 6½% copper. Work was done at the Wheal Julia mine also, and some oxidized ore was sent to the leaching floors. Many improvements have recently been introduced. Briquetting plant for fine ore, and sorting plant have been erected. Diesel oil-engines have been substituted for steam plant, with a substantial saving in cost. The Elmore concentrator, originally erected at an outlying mine, has been removed to a site convenient to the smelter. The accounts for the year show an income of £173,601 from the sale of products, and a net profit of £78,264, out of which £70,748 has been distributed as dividend, being at the rate of 37½ per cent.

Globe & Phoenix.—The report for 1912 of this company, owning the premier gold mine of Rhodesia, contains much more information than has characterized

tons of the same grade a year before, so that a substantial amount of this reserve has been raised during the year, without any new supply having been discovered. The amount of ore sent to the mill was 72,923 tons, and the yield was 117,307 oz., worth £495,758. The yield per ton was £6. 12s. The working cost was £120,863, or 35s. 7d., leaving a working profit of £351,634, or £4. 16s. 5d. per ton. Out of this profit, £17,889 was allowed for depreciation, and £15,415 was paid as income tax. The directors' extra remuneration was £15,000, and £3516 was spent on London administration. The shareholders received £280,000, being at the rate of 140%, and £76,312 was transferred to reserve.

Hollinger Gold.—The second annual report of this Canadian company, operating at Porcupine, shows that milling and cyaniding was started in June 1912.



PLAN OF KNIGHT CENTRAL WORKINGS.

the previous reports issued during the 18 years' existence of the company. No doubt the improvement is due to the recent agitation chronicled in our editorial columns. The report begins by referring to the adverse circumstances due to the drought and shortage of labour, and also to the necessity of replacing the timbers in the main incline shaft. The developments during the year on the 19th level have shown an improvement, but on the other hand, no very rich ore has been disclosed, as the rich shoot has been lost in broken ground. On the whole the developments justified the commencement of the new vertical shaft in June of last year. This is expected to intersect the lode at the 23rd level at a vertical depth of 2300 ft. The reserve at December 31 was calculated at 170,945 tons, averaging 33.8 dwt. per ton, as compared with 179,427 tons, averaging 35.6 dwt. six months before, and 173,613 tons, averaging 37 dwt., on December 31, 1911. The very rich ore stood at 23,503 tons, averaging 5 oz. 16 dwt. per ton, as compared with 31,870

From then to the end of the year, 36,446 tons from the mine and 8749 tons from the dump, a total of 45,195 tons, was milled, yielding gold worth \$933,682, or \$21.44 per ton. Some of the dump-ore treated during the first few weeks, while the mill was running experimentally, was of lower than average grade, and also toward the end of the year during the strike of the miners less ore and of lower grade was treated. The net profit was \$600,664, out of which \$270,000 has been paid as dividend, \$106,222 written off plant, and \$102,639 written off development account, leaving a balance of \$101,801 carried forward. The manager, P. A. Robbins, estimates the reserve at 644,540 tons, averaging \$18 per ton. Of this, about one-third is in No. 1 vein, another third in No. 2 vein, with important amounts in Nos. 3, 4, and 37, and the remainder in numerous other veins not fully developed. Modifications were made in metallurgical treatment by substituting cyanide for mercury in the pans used for grinding concentrate; and altering the system in the agita-

tors from the Trent to the Dorr, rendered desirable by the heavy nature of the ore.

Mason & Barry. This company was formed in 1878 to acquire the San Domingos copper and sulphur mine at Mertela, Portugal, just over the border of Spain, and in the same belt of pyrite deposits as the Rio Tinto, Tharsis, and others. The mine was worked privately by the vendor firm for twenty years previously. In 1892 and subsequently, the nominal capital was reduced by the return of cash out of profits, the denomination of the shares being gradually reduced from £5 to £1. The present capital is £185,472. The report for 1912 shows that 125,963 tons of pyrite was raised, and that the shipments of raw and washed ore were 350,733 tons. No details are given as to the production of copper, or as to the nature of the ore mined and shipped. The accounts for 1912 show a profit of £85,065, out of which £20,000 has been placed to reserve, and £64,810 distributed as dividend, being at the rate of 35 per cent.

Balaghat Gold.—This company belongs to the group in the Kolar district of India, managed by John Taylor & Sons. The mine is the most northerly, and has been the least successful of any that is now being worked. Operations were started in 1886, and three re-constructions were necessary before profits were made. Dividends aggregating £227,800 were paid from 1900 to 1907, but since the latter date, both the content and the amount of ore have fallen. During the past four years the mill has been working at about two-thirds capacity, the yearly tonnage being about 42,000, the yield per ton has been about 30s., only half what it was in 1905. The report for 1912 shows that 42,435 tons of ore was sent to the mill, yielding gold worth £66,412. The working cost, including royalty, was £64,780, and £4053 was allowed for depreciation. The adverse balance at the beginning of the year was £11,036, and at the end of the year £11,603. Developments during the year have yielded some high-grade ore on the western lode, but nothing has been found on the main lode. The reserve on December 31 was 24,725 tons, a figure practically identical with that of the year before. H. M. A. Cooke, the superintendent, continues to be hopeful for future discoveries, and he reports that the high grade of some of the ore in the western lode will make it possible to combine with it some of the other ore that was previously on the boundary line of profitability. The company has reserve capital in hand, so that no pause will be necessary in development work.

Ooregum Gold. This company owns one of the John Taylor & Sons group of gold mines in the Kolar district of India, and has been producing since 1888. The grade of the ore has never been so high as at the Mysore mine, and on more than one occasion considerable anxiety has been felt as to future developments. Nevertheless dividends have always been paid. During the year 1912, much of the development work was disappointing, but toward the latter part of the time ore of better quality was disclosed, so that at December 31 the reserve stood at practically the same figure as on January 1, the amount being estimated at 186,393 tons. The report of R. H. P. Bullen, the superintendent, refers to discoveries at the 4610 ft. level of ore of higher grade. At one place such ore has been found below 1000 ft. of barren ground. During 1912, the ore raised was 145,558 tons, and the yield 82,212 oz., worth £347,943, being a recovery of 11½ dwt. or 37s. 10d. per ton. The working cost was £177,963, or 24s. 5d. per ton. In addition, £6447 was spent on plant, £6193 on the Manighatta option, £8000 paid for ground on the dip, £8564 as income

tax, £5000 written off for depreciation, and £15,000 placed to reserve. The shareholders received £120,231, being 40% on £120,000 preference shares, and 30% on £210,772 ordinary shares. The total yield to date has been £6,278,650 from 2,248,710 tons of 2000 lb., and the dividends have aggregated £2,085,069. The slime-plant was started in March 1912. The Manighatta property, 16 miles to the north, on which the company had an option, proved to be a failure, and has been abandoned.

Mount Boppy Gold. This company was formed by John Taylor & Sons in 1899, to acquire a gold mine in the Cobar district of New South Wales. At the time of flotation, the metallurgical plant of the Gallymount mine was purchased. Dividends have been paid regularly from 1902 to 1911. Unfortunately, operations were seriously curtailed during 1912 by the severe drought, the months of May and June being practically lost. The yield per ton treated also showed a slight decline. Not only was no dividend paid for 1912, but it has been deemed advisable to raise £30,000 additional capital by the issue of preference shares, in order to pay for the new plant erected for the better treatment of the sulphide ore. During the year, 53,990 tons of ore was raised and sent to the mill, where 68% oz. gold was recovered by amalgamation, 9861 oz. by cyaniding, and 360 oz. in concentrate, making a total yield of 17,117 oz., worth £72,485, or 0½ dwt. per ton. The working expenditure was £73,610, in addition to which £2246 was paid as tax and £2551 allowed for depreciation. The development during the year has given satisfactory results. The future of the mine depends largely on the nature of the lodes in depth. At present the two lodes constitute the two sides of a 'trough,' and how this will behave at depth is the cause of some speculation. The reserve on December 31 was 208,597 tons. The new plant containing 4 tube-mills and Moore filters has been erected. James Negus is the superintendent.

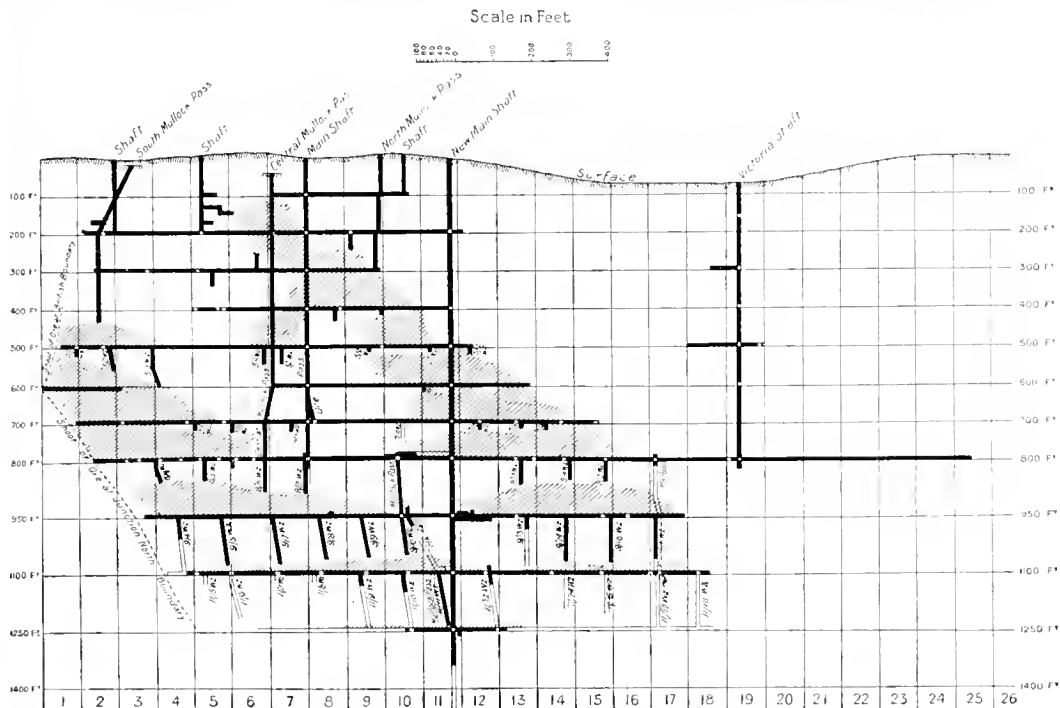
Gibraltar Consolidated Gold. This company was formed by John Taylor & Sons in 1895, to acquire a gold mine in the Adelong district of New South Wales. Milling commenced in 1897, but after the payment of a dividend in 1898, reconstruction for the purpose of providing new capital was necessary in 1900. Results since then have been unsatisfactory. The report for 1912 shows that developments during the year have been more encouraging, for between the 600 and 900-ft. levels a fair amount of profitable ore was disclosed. Owing to shortness of funds, it has not been possible to adopt a vigorous policy of development, but the directors have under consideration a scheme for expanding operations, should the recent improvement continue. During the year, 6040 tons of ore was milled, and 5540 tons of sand and slime cyanided, for a yield worth £25,127, or about 1 oz. per ton. A profit of £6035 was made, which went to partly expunge the adverse balance of £8888 with which the year commenced.

Amalgamated Zinc (De Bavay's).—This company works the De Bavay flotation process at Broken Hill, and treats the zinc tailing produced at the North, South, and Block 10 mines. The report for the six months ended December 31 shows that 278,634 tons of material was treated, and that the production was 76,517 tons of zinc concentrate averaging 49.1% zinc, 6.1% lead, and 8.8 oz. silver, and 1061 tons of lead concentrate averaging 52.3% lead, 17.7% zinc, and 35 oz. silver. The working profit, estimating zinc at £22 per ton, was £84,757. To this is added the extra profit from previous periods on the final settlements, £70,537, making a total profit of £155,295. The sum

of £62,500 was distributed as dividend, being 12½% on the capital £500,000, £26,009 was written off, £25,000 placed to equalization reserve fund, £5000 placed to reserve for depreciation, and £33,400 added to the balance in hand. Altogether £325,000 has been distributed as dividends since the formation of the company three years ago, and various reserve funds amount to £164,000.

North Broken Hill.—The report issued by this company covers the 5 months ended November 30 last, on which date the company was re-organized with £600,000 capital instead of £200,000, the alteration being made solely to bring the nominal value of the shares more nearly equal to the market value. The mine is one of the two in the district that has a long

North Coolgardie district of West Australia. Bewick, Moreing & Co. are the general managers. The best results were obtained in the years 1903 to 1905. The report now issued covers the year ended December 31 last, and shows that the ore reserve has been increased and stands at 3½ years' supply, the average grade being much the same as the year previous. During the year, 155,603 tons of ore was raised and sent to the mill, where 24,867 oz. was recovered by amalgamation, 6041 oz. by cyaniding sand, 20,514 oz. by cyaniding slime, and 4862 oz. in concentrate. In addition, 969 oz. was obtained by the treatment of accumulated slime, 784 oz. from cyanide slag, and 338 oz. from old amalgamation plates, making a total of 58,376 oz. The income was £263,670, and £3100 was received as



NORTH BROKEN HILL, LONGITUDINAL SECTION.

life before it. During the period under review, 125,738 tons of ore was raised, chiefly from the 950, 1100, and 1250-ft. levels, averaging 15.81% lead, 13.35% zinc, and 7.18 oz. silver. The yield of lead concentrate was 21,781 tons, averaging 69% lead, 6.89% zinc, and 22.19 oz. silver. Other products were 58,178 tons of zinc tailing, averaging 3.79% lead, 18.36% zinc, and 3.87 oz. silver, which was delivered for treatment to the Amalgamated Zinc (De Bavay's); and 11,441 tons of slime, averaging 14.7% lead, 15.9% zinc, and 9½ oz. silver, some sold and some stored for future treatment. The main shaft has been sunk to 1450 ft. and a level is being opened at 1400 ft. The ore reserve is calculated at 2,186,000 tons. The accounts show an income from the sale of lead concentrate, zinc tailing, and slime of £284,104, and the working profit was £172,334; management absorbed £3031, and £17,199 was allowed for depreciation. The shareholders received £160,000 as dividend.

Sons of Gwalia.—This company was formed in 1898 to acquire a gold mine at Mount Leonora, in the

interest, etc. The net profit, after taxes were paid and depreciation allowed, was £59,493, and £23,473 undivided profit was brought forward from the previous year. The shareholders received £69,062, being at the rate of 21¼%. Adjoining property has recently been purchased, and additional ground is under option.

Great Boulder Perseverance.—It is pleasant to be able to record that this company, working one of the Kalgoorlie gold mines, has been able to return to the list of dividend payers. It will be remembered that in the boom days of West Australia, the company made large profits from bonanza ore. On the exhaustion of the rich shoots in 1904, attention was turned to the extensive bodies of comparatively low-grade ore. Dividends, on a much smaller scale, were continued until 1909, when the surface plant was seriously damaged by fire. Subsequent to the rebuilding of the mill, the content of the ore raised decreased to such an extent that it was found desirable not to distribute any profit for 1911. The report for 1912 shows that 234,636 tons

of ore was raised, producing 62,932 oz. gold and 7838 oz. silver, worth £270,760. After due allowance for depreciation and taxes, the divisible profit was £25,681, and with £67,082 brought forward from the previous year, the total balance was £92,733. Out of this, £33,956 has been distributed as dividend, being at the rate of 23%. During the year, development has added to the ore reserve, which on December 31 stood at 498,260 tons, averaging 24s. 9d., together with 358,480 tons of probable ore estimated at 21s. 4d. per ton. The indications are that the two lodes now being exploited will continue to provide ore as development proceeds. The output of ore during 1912 was restricted for a short time while the main shaft was re-centred. In our issue of May 1911 we published a flow-sheet of the mill as rebuilt. The plant consists of ball-mills for dry-crushing, roasting furnaces, Wheeler pans for grinding with cyanide solution, tube-mills, agitation vats, and filter-presses. Hooper, Speak & Co. are the general managers.

Ivanhoe Gold Corporation.—The report of this company, operating at Kalgoorlie, West Australia, for the year 1912 shows that developments at depth have been distinctly disappointing. The ore-shoot on the 2420-ft. level is only 200 ft. long, and consists of low-grade though still profitable ore, while on the 2570-ft. level the lode so far exposed contains no profitable ore. The consulting engineers, Bewick, Moring & Co., and the manager, R. B. Nicolson, are of opinion that conditions may improve at greater depth, and cross-cutting to the lode on the 2720-ft. level is now in hand. The ore reserve has not been increased during the year by the discovery of ore, though the total has been maintained owing to the fact that in several parts of the mine the orebodies have proved to be wider than anticipated. During the year, 237,266 tons of ore was sent to the 100 stamp mill. Gold worth £117,271 was won by amalgamation, £104,453 by roasting and cyaniding concentrate, £66,646 by cyaniding sand, and £180,743 by cyaniding slime. The total yield was worth £471,483, being a recovery of 89½%, and the balance of profit was £190,167. The shareholders received £190,000, being at the rate of 19%, as compared with £220,000 the year before. The most prosperous year was 1903, when gold worth £555,635 was extracted from 149,131 tons of ore, and £225,000 distributed as dividend, and during the following 6 years the yield was slightly less and the profit slightly greater. During 1912, the yield per ton was 39s. 6d., a drop of 1s. 3d. as compared with 1911, and at the same time the working cost per ton was increased by 1s. 5d. to 22s. 1d., owing chiefly to the greater expenditure on timbering. The ore reserve on December 31 was calculated by Mr. Nicolson at 1,080,850 tons, averaging 40s. 7d. per ton, a decrease of 7571 tons in tonnage and of 3s. per ton in assay-value. This is sufficient to last for 4 years. The total dividends distributed to date have been £3,100,000, and £864,042 has been written off expenditure on plant and developments out of profits. The total yield has been worth £7,039,325, obtained from 2,522,852 tons of ore.

Waikato Gold.—The report for 1912 of this company, the premier gold producer of New Zealand, reflects the effect of the strike and of the impoverishment of the lower levels. Reference has been made to the latter many times in this magazine during the last two years. The strike lasted from May 13 to October 2, 1912, during which time the mine and mills were closed. During the period of working, 147,828 short dry tons was treated, and the production was 58,540 oz. gold and 427,078 oz. silver, selling for £278,435. In addition, bullion worth £54,347 was recovered at a

general clean-up of the cyanide plant and refinery during the strike. The working cost was £174,078; £32,726 was allowed for depreciation, £31,700 charged to income tax, and £25,000 devoted to capital expenditure on the Hora-Hora hydro electric scheme. The shareholders received £148,772, being at the rate of 30%. The strike greatly interfered with development, and the reserve on December 31 was estimated at 750,634 tons, as well as 711,511 tons left in pillars. It is proposed in future to extract 15,000 tons during each 4 weekly period. The yield from this is estimated at 33s. per ton, sufficient to provide a 5% dividend every quarter for four years. The construction of the hydro-electric power installation at Hora-Hora has progressed slowly on account of labour troubles, but it is expected to be completed about the end of the current year. Efforts to obtain other properties have proved unavailing, though 60 have been brought to the notice of the board. The company has a reserve fund of £341,076, invested in first-class securities.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

Chalmers & Williams are the exclusive licensees and manufacturers of the 'Torpedo Conveyor,' a new type of conveyor that promises to have wide application.

W. Hasendahl, formerly Managing Secretary for the British Humboldt Engineering Co., is now assistant to H. I. Keen, European manager for the Allis-Chalmers Manufacturing Co.

The Sullivan Machinery Co.'s Catalogue No. 110 is in Spanish, and gives particulars concerning diamond-drills, rock-drills, and compressors. Useful conversion tables are included in the 68 pages of well printed and well arranged matter.

Arthur R. Brown should be credited with the manufacture of the new 10 cu. ft. dredge now in operation at Perak, Federated Malay States, for the Malayan Tin Dredging Co., Ltd. F. W. Payne & Co. designed and erected the dredge, which is digging to fifty feet.

N. Guthridge, Ltd. have issued a bulletin describing the Card Concentrator, which goes into minute details of construction and operation. The table is in operation at the Cornwall Tailings Co., near Redruth, Cornwall. Tin dressing is now being given so much attention that the excellent qualities of this particular concentrator are well investigated.

The Coventry Chain Co.'s catalogue gives much material for reflection. The accuracy required through the various stages of manufacture is an essential to the perfect results necessary in a chain drive. We are informed that in a 5-ft. chain of the roller type there are 601 pieces, some of them requiring as many as nine operations to complete. It would be well for engineers designing new equipment to consider the claims made for transmitting power by chain-drive.

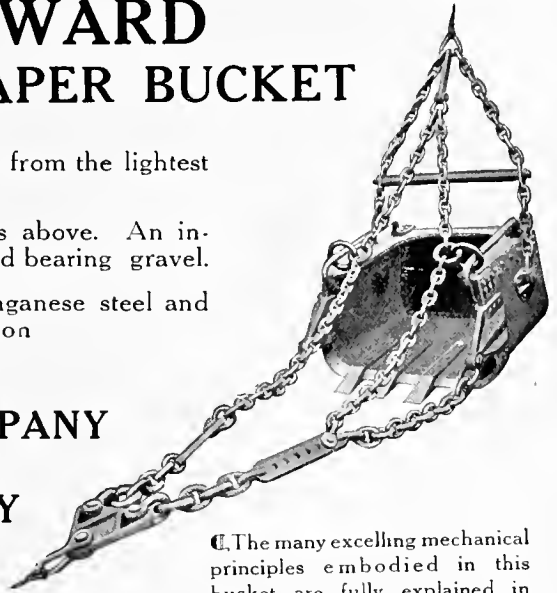
Fraser & Chalmers' new catalogue on Dredges rightly states in the preface that there has been a great development in this type of machine. The chapter on Dredge Design brings forth many arguments in favour of the close-connected type of bucket-line as against the open-link type, and favours the 'spud' rather than the headline. Recognition is, however, given to advantages to be derived from using the open-link type where large boulders or sunken trees are likely to be encountered. The catalogue throughout shows an intimate knowledge of dredge design, and, what is more, the operation.

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MOUNT BOPPY GOLD MINING CO., LTD.

THE fourteenth ordinary general meeting was held on April 14, at the Cannon Street Hotel, E.C. 4, Mr. Sidney F. Hottnung-Goldschmid (the chairman) presiding.

The Chairman said that the career of the Mount Boppy mine had been marked by almost unvarying success, such as was given to few mining companies to achieve, and they could hardly expect that this result would continue without any interruption, however temporary. This interruption had undoubtedly been experienced during the year under review. But he wanted them to realize that such had been the result, not of any serious deterioration in the mine, not through any lack of activity in the work, but solely from causes over which no human being could have control. They had had to contend against the forces of nature. Work was stopped by one of those periodical curses that Australia was subject to—drought. It lasted for several months, and not only interfered with operations generally, but actually stopped the crushing by the mills even on the diminished scale that was possible owing to the change of system and the erection of the new plant. Notwithstanding these drawbacks, their reserves had been but slightly reduced.

The labour troubles in 1911 culminated in a strike, and the net result to the company was a large increase in the wages bill that their working for the past year could ill afford to bear.

During the twelve months under review the battery ran 263 days, crushing 53,990 tons of ore, from which the total production from all sources amounted to 17,117 oz. of fine gold, an average yield of 6 dwt. 8 gr. of fine gold per ton of ore. In comparison with the previous year—1911—there was a decrease in ore crushed of 20,142 tons, and of gold produced of 9267 oz. of fine gold, equalling £38,738. There were serious interruptions to the running of the mill, and for no less than 27 days the mill was entirely idle. The sale of gold realized the sum of £72,485, and adding interest and transfer fees, the total revenue was £72,597. The expenditure amounted to £73,610, leaving a debit balance of £1012 on the actual working of the mine. The profit and loss account was debited with income-tax, £2243; depreciation, £2551; Redhill Extended option, £417; and loss for the year 1912, £1012; totalling £6225; leaving a sum of £5496 to the debit of profit and loss account at December 31, 1912.

At last year's meeting the chairman stated that an addition to the capital might become necessary, and he expressed those views of the Board even before the unforeseen stoppage of operations had made it impossible to defray the cost of the new plant out of their resources. Much as the Board hoped to have avoided the need for new capital, they were now forced by circumstances to fall back upon the measures originally rejected, namely, an increase in the capital. Failing this, they would have to rely entirely upon the anticipated profits for working capital, and to extinguish, as it was now being gradually extinguished, their indebtedness. But this could only be effected by ceasing to pay dividends for a considerable time. The directors were averse to this plan, because they believed such a drastic measure would not be acceptable to the general body of the shareholders. The Board came with the most moderate proposal that, after

careful and lengthy consideration, they could evolve. They proposed to increase the capital by the creation of 30,000 shares of £1 each, carrying a cumulative preferential dividend of 10% per annum, and those preference shares, after the 10% dividend had been paid, would rank for further dividend *pari passu* with the 121,000 shares already issued. A further condition was that these shares should, after they had received 100% ordinary dividend after the 10% preference dividend, become automatically ordinary shares, and rank equally for dividends with the 121,000 shares now issued. The new capital would enable them to pay the few thousand pounds borrowed, and would give a fair amount with which to pursue developments and open up the mine; and it would also pay for the new boilers that were necessary, and for any plant required.

The new plant would improve the gold extraction and economize labour. The saving by this new plant would amount to about £16,000 per year. The reserves in the mine amounted to 208,597 tons, so that there was in sight nearly three years' supply for the mill. In view of the serious interruption to work during last year, this must be regarded as highly satisfactory. The cablegram just received from Mr. Negus, dated the third of the month, stated: "Normal condition returning. The new plant is gradually settling down to good work. Underground developments continue satisfactory. The first stope above the back of the No. 7 level proves the width of the lode is 14 ft.; average assay is 10½ dwt per ton. About to resume sinking winze below level No. 7. The main water supply tank is full." Speaking generally, the stopes had continued to produce a payable grade of ore, and in places had disclosed valuable sections of ground.

It seemed almost superfluous to remind shareholders that the Mount Boppy mine had paid in dividends £419,582. The Board had confidence in the future of the property, and could recommend to the shareholders the need and the advantage for strengthening the company by the issue of the fresh capital. In concluding his remarks the Chairman placed on record the regret of the Board, and of the shareholders, at the sudden and premature death of their able and experienced metallurgist, Mr. W. D. Williamson. He was for many years in the service of the company, and his great devotion to the interests confided to him made him a most valued servant, whose loss they greatly deplored. The Board had appointed as his successor, Mr. A. Chapple, who they had every confidence would discharge the duties of this important position in a satisfactory manner. To Mr. Negus they owed their warmest thanks, as they recognized in him a manager entirely devoted to the company in his charge. He had given repeated evidence of resourcefulness and tact in dealing with serious and oft-times difficult situations, not only in regard to the general affairs of the company, but in settling perplexing labour troubles, to which Australian undertakings were unfortunately subject.

Major-General P. D. Henderson, C.S.I., seconded the resolution for the adoption of the report and accounts, and it was carried unanimously. The proposals to create new capital were also adopted unanimously.

CONSOLIDATED MINES SELECTION CO., LTD.

THE seventeenth ordinary general meeting was held at Winchester House, E.C., on April 15, Mr. Walter McDermott (the chairman) presiding.

The Chairman said that the year had been marked by the entrance of the Brakpan mine into the dividend-paying list, with distributions of £300,000, equal to 40% on its capital. This first year's return, satisfactory as it was, was not the maximum which could fairly be expected from the existing mill, because the average number of stamps running during 1912 was 135, while there were 160 now at work. The mill was planned and built for 200 stamps capacity, and the last 40 were now on order. But it was not the intention to immediately equip the whole mill in proportion to this addition of stamps; they were for the present partly to take the place of extra tube-mills to insure finer grinding, and partly to equalize certain irregularities in power-supply and ore-supply affecting the monthly capacity of the mill. Late experience on the Rand tended to the belief that some of the grinding work, which had been crowded more and more on to tube-mills, could be more economically performed by carrying the crushing by stamps a little further. The mine had opened wonderfully well. The reef, as far as now opened, averaged wider than was expected; it was somewhat richer than the early hopes of average value, and it had exhibited a tendency to a fairly well-marked separation of profitable from unprofitable areas, which was of very great advantage for cheap and safe working of the mine. There were good grounds for anticipating some reduction in the working costs, which were about 17s. 4d. last year. The Transvaal Coal Trust, in which they owned many shares, was the largest shareholder in Springs mines, and still held 253,500 shares in Brakpan, so that their interest in those two mines was an important one indirectly, as well as directly. They were, therefore, able to look forward to dividends from the Transvaal Coal Trust earned by its gold shares, as well as by its regular trade in coal.

They would find reference in the directors' report to certain investments which had remained stationary, or had depreciated, or had involved actual loss, as, for instance, the West African venture and their interests in quicksilver mines in Asia Minor, full provision for which, however, was made in previous accounts.

They were intending to undertake the actual development of the Springs mine, where the reef had lately been struck in one of the two shafts. The first assays of the reef were encouraging; but, quite irrespective of immediate assays in either shaft, they felt it necessary and desirable to raise more money for developments, after all that had been spent in getting shafts down. With their present good prospects of regular income, they might play the safer game of sitting on their various interests, instead of devoting themselves again to developing other dividend-payers, but they had more reason for hope in regard to the Far Eastern Rand than when they first entered that part of the field; they had the position, the experience, and the organization for continuing their active African policy, and their engineers advised them to proceed. They were not intoxicated by the success of Brakpan, and fully recognized the risk connected with such mining development, but it was exactly the kind

of risk it was their business to undertake. For Springs Mines, Ltd., there would be an issue of £315,000 6% debentures, with which would be issued certificates for options on an equivalent number of shares at par for three years. The sum to be raised by this issue would provide for the energetic and thorough development of a very large section of the Springs area. The debentures would be offered to shareholders in the Springs and Transvaal Coal Trust companies, and the whole issue had been underwritten.

Their financial position was very satisfactory. They had cash assets in excess of liabilities of about £225,000. The cash was not idle, of course, but was made to work for fair interest. The debenture debt was reduced to £116,000. In the balance-sheet the shareholdings were taken at cost, or market price if less, and at the end of the year showed a substantial appreciation at market quotations. To carry this statement a little further, and at the same time to anticipate a question similar to one asked by a shareholder last year, he would say that their present holdings in Brakpan and Transvaal Coal Trust alone, if taken at to-day's quotations, would be in excess of their whole capital of £552,500; while the value placed on all their African shares in the balance-sheet was only £408,277. At the extraordinary meeting in June, 1911, when they reduced the capital, a shareholder expressed the hope that the directors would not start the building-up of a big reserve fund, and ask the shareholders to keep on waiting for dividends. They would see from the directors' report that they had ventured to recommend starting a reserve with £15,000, but only after paying a dividend of 10%. They would probably agree that this compromise was desirable in a business like this, where a reserve was a most useful attachment to help withstand the sudden fluctuations in values of holdings.

Several changes had taken place in the directorate. In the death of Mr. J. G. Hamilton, they had had the misfortune to lose an able managing director in South Africa, where he was universally respected and very popular. He occupied several public positions of responsibility in connection with the mining industry; and, as chairman, he managed the affairs of the Transvaal Coal Trust, Brakpan, and Springs Mines. They had appointed Mr. Honnold in his place; and Mr. Knecht, their former assistant-engineer, became their consulting engineer. Mr. Lynch, who had proved the value of his services to the Johannesburg organization, would assist Mr. Honnold in all business matters. Messrs. E. T. Patterson and Louis Oppenheimer had joined the Board, and they brought valuable business experience and connections to the service of the company. The Board was a large one, and this because they were an Anglo-German company, and had four directors in Germany. Their colleagues abroad were always in close touch with business here; they visited them occasionally, and were consulted in all important details of policy. In concluding, he expressed the thanks of the Board to Mr. Honnold and his staff for their long-continued efforts in the conduct of the technical work of the three properties they were so largely interested in.

Mr. B. Kitzinger seconded the resolution for the adoption of the report and accounts, and it was carried unanimously.

THE CENTRAL MINING & INVESTMENT CORPORATION, LIMITED.

The eighth Ordinary General Meeting of The Central Mining & Investment Corporation, Limited, was held in the Board Room at No. 1 London Wall Building, F. C. on Friday, May 1915, Mr. F. Eckstein presiding.

The Secretary (Mr. T. Bluch) having read the notice convening the meeting, and also the auditors' report.

The Chairman said: "Before dealing with the business for which we are assembled, it is my sad duty to refer to the great loss the Corporation has suffered by the death of its late Chairman, Sir Julius Wernher, Bart. As you know, Sir Julius was one of the founders of this Corporation, and was its active Chairman and guiding spirit from the beginning up to the time of his death, which occurred only seven days after our last annual meeting.

Having been intimately associated with him for a great many years, both in business and in private life, I am in a position to tell you how much he cared, thought and laboured for this Corporation, and that his interest in its welfare never ceased, even during his long and painful illness.

I do not think it out of place if I say a few words more about this great and remarkable man, who went through life, and a very strenuous life, without ever making a single enemy, and who remained all through his career a simple minded, honourable man, and staunch friend.

Sir Julius went to Kimberley in 1871 and stayed there for about ten years, after which he settled in London permanently, making only two or three short visits to South Africa. His work in connection with the diamond and the gold mining industries is so well known that I need not dwell on it here. But what perhaps is less known is the leading part he took notably in educational and charitable institutions, both of which he had much at heart and for which he cared and worked to the last. To his colleagues on the Board he set a high standard, which we are trying to live up to. The loss to this Corporation will be long felt, and his memory, I am sure, will be cherished and held in highest esteem by all who had the privilege of knowing him.

As usual the report and balance sheet have been posted to all our registered shareholders, and I therefore propose to take them as read.

In going through the balance sheet you will find the capital account and the depreciation reserve account the same as last year. The latter amount more than covers the depreciation, which unfortunately has still to be taken into account.

The reserve account figures now as £140,000, or an increase of £40,000 which we have taken from our last year's carry-forward.

Creditors are £2,700,000 odd. As explained to you last year, this item will always be considerable at the time of the closing of our books, as the greater proportion represents the accumulation of funds of the various gold mining companies, for whom we act as bankers, for their respective dividend payments at the beginning of February.

The next item is the proposed dividend, and a resolution dealing with same will be moved by me later on.

Then comes the remuneration of the participating directors of £19,957 4s 9d—and finally, on the debit side, a carry-forward of £72,197 18s 7d—which is just about 45000 more than last year.

On the credit side you will find two items of £5,087,368 28s 5d and £1,344,362 6s 11d, or together £6,421,730 34s 6d, representing our holdings in shares, investments, etc., which is £600,000 more than last year.

Debtors are £168,290 19s 2d, as against £384,000 last year. Loans amount to £860,600 17s 6d, or nearly half a million more than in the preceding year.

Bills receivable are £596,395 3s 11d, against £327,000, and cash £574,486 18s 2d—almost the same as last year. In other words, our liquid assets at the end of the financial year amounted to, roughly speaking, £3,500,000, against which we owed £2,700,000.

Turning to the profit and loss account, our income from dividends, interest and commissions, &c., was £319,000, which we are able to bring forward in its entirety to the appropriation account, as other realised profits covered all our expenses, including a sum of £17,000 for income tax.

Considering the unsatisfactory year we, in common with all kindred Corporations, passed through, you will not, I trust, be dissatisfied with the result.

The principal field of our operations is still in South Africa, and I would like to call your attention to the report of our Consulting Engineer, Mr. Marriott, accompanying the directors' report and balance sheet, which deals concisely with the majority of our interests.

During the year under review, the mining industry of the Witwatersrand basin, as a whole, made good all-round progress. The total output of the gold mines on the Rand for the past year amounted to 8,753,568 ounces, compared with 7,896,802 ozs for the preceding year, and represents an estimated working profit of £13,025,227, or an increase of £1,637,427. These results have

been obtained from the crushing of 23,486,361 tons of an average yield of 29s. per ton.

The increase in tonnage crushed, namely, 1,598,000 tons, is due to new producing mines, larger crushing capacity of some of the older mines and the improvement in the labour position during the latter part of the year as compared with the same period of the preceding year. The introduction of small machines and other mechanical appliances has made it possible also to increase the efficiency in mining and to transport ore with less labour underground.

It may again interest you to hear that your Corporation handled during the past year 3,615,111 ozs. of standard gold, realising the sum of £13,100,953, being 34% of the entire gold production of South Africa and about 14½% of the entire gold production of the world.

The dividends paid by the mines under the management of the Johannesburg Office amounted to 53% of the total amount declared by the Witwatersrand mines, as against 48% in 1910 and 47% in 1911. This is the more satisfactory as the value of the declared and actual output of these mines amounted to £14,564,700 out of the total of £6,814,804 or 40%. I should like to repeat this interesting statistical information, namely, that our share in the gold output was 40% and our share in the dividends 53%, which you will admit is a good testimonial and reflects creditably on our Consulting Engineers, Managers and all our mine employees. Furthermore, the dividends declared for the whole Rand amounted to 61% of the declared working profit, or an average of 6'2s. per ton milled, whilst the mines of your group, included in this total, paid out as dividends 73% of their declared working profit, or 9'3s. per ton milled. It is interesting to see what became of the remaining 27%, amounting to £1,568,000, or 3s. 10½d. per ton milled.

The chief items making up this amount are as follows:—

For profit tax	£
Re-investing in the mines on legitimate capital account, which includes annuities payable on account of Betsaraplaatsen acquired ..	62,200
Accessory expenditure not included in the regular working costs	207,000
<i>This makes a total of</i> £1,410,000	
The remaining	£158,000

form part of the increased carry forward in the balance sheets of the companies.

The working costs of the whole of the Witwatersrand were about 4d. per ton higher than in the preceding year. The increase on the mine more closely associated with us amounted to about 6d. per ton, whilst the profit per ton was 13s. 4d., or 2d. more than in the year before. This increase in cost is due to the completion of the work of re-organisation and ventilation, to extra expenditure on recruitment of labour and additional outlay in consequence of recent legislation. Much of the work taken in hand is now completed and we may look forward during the current year to a further increase in the tonnage of ore mined and profit earned.

The metallurgical work during the year shows considerable advances.

We treated in 1910 6,752,348 tons at an average cost of 4s. 6d.
 " " " 1911 7,595,192 " " " " 4s. 5d.
 " " " 1912 8,214,944 " " " " 4s. 2d.
 and the extraction likewise shows a steady improvement since 1910.

As regards native labour, all the mining groups with one exception entered into an agreement in October last, whereby the whole of native labour recruiting in British South Africa is performed on their behalf by the Native Recruiting Corporation, Limited. The agreement provides for the equitable distribution of native labour amongst the individual companies who are members of the Recruiting Corporation and thus eliminates competition in obtaining natives. These new arrangements are of great importance to the mining industry, as the competition for native labour, owing to the inadequate supply, has of late unduly increased the cost of recruiting. I do not think there will be any immediate direct saving to the companies under these new arrangements, but, on the other hand, if this new agreement had not been arrived at, the cost of recruiting would have undoubtedly further increased to a considerable extent. In time I have no doubt a material saving will result to the companies, not only in the cost of recruiting, but also in the efficiency of the native workers owing to the united action of the groups. For this reason the mining industry as a whole is to be congratulated on having achieved this arrangement, and we can only hope and trust that it will be a lasting one. Our mines have now over 65,000 natives in their service, whilst the highest number previously employed at any one time was 59,500. I have dealt so

fully with this subject as it is of such paramount interest to the industry in which you are so largely interested.

As you are aware, a considerable portion of the mining companies on the Rand obtain all their power from the great power stations lately erected, and it may interest you to hear that the total plant installed at the end of last year was as follows: At Rosherville, 5 electric generators, 6 steam compressors; at Vereeniging, 2 electric generators; at Robinson Central Deep, 6 compressors; having a total rated capacity of no less than 141,000. These generating plants have been continually at work, subject to breakdowns—of which, unfortunately, there have been a great many during the past year. On the whole, however, the installation is a success, but even at the present moment when all the plants are in full working order, our mines are still short of their full requirements, both in electrical power and air. It does not appear likely that the full amount required, both in power and air, will be given before the beginning of 1914, and it follows, therefore, that some of the companies are still working with steam compressors and a number of mills are being run on steam.

It is not my intention today to deal with the progress made by the individual companies during the year under review, as our consulting engineer has fully described this in his report. I must refer, however, to one or two cases, and particularly to the Crown mines, where the scheme of reorganization has now been completed, and where we now confidently look forward to reaping the anticipated results. It has been an anxious work and a big undertaking to reorganize the whole underground working without disturbing for a single day the ordinary daily routine and output, and the general manager deserves the highest credit for this splendid performance.

During the past year, our Corporation, together with the Rand Mines, Limited, guaranteed a 5% debenture issue of £1,000,000, which, I am happy to say, proved a marked success, inasmuch as the issue was over-subscribed by about 25 per cent.

At the City Deep, in which your Corporation is so largely interested, we have not yet, I regret to say, achieved those results which we have every right to expect and which we must get in time. The excuse for the non-fulfilment of these legitimate expectations has always been shortness of labour and several unforeseen difficulties in getting into full swing on a large scale. Within the last few months considerable additions to the number of native workmen have been received, and effective steps have been taken to remove the other drawbacks to expansion, and we are confidently looking forward to better results.

I understand that the City Deep contemplates selling a few claims on the extreme western limit of their property, which can be more economically worked by their neighbour—the City and Suburban Company—owing to the presence of a dike, which would in that case form a natural boundary. Full particulars will no doubt at the proper time be submitted to the shareholders of the companies concerned.

The most interesting developments of late on the Rand have undoubtedly taken place in the far eastern section, as demonstrated by the operations of several of the companies located in that neighbourhood. Amongst these I should like to mention the results achieved by the Brakpan company, which, as you know, is so excellently managed by our friends, the Consolidated Mines Selection Company, Limited; and everybody is looking forward with considerable interest to the exploitation of the Government areas, which are under the energetic control of Messrs. Barnato Bros. Our Corporation is chiefly interested in that district in the New Modderfontein Gold Mining Company, and in the Modderfontein B. The latter company has, I am happy to say, more than come up to our expectations from the first day the mill began to work, and so enabled its directors to enrol it amongst the dividend-payers of the Rand at a very early period. The mine is splendidly laid out and reflects great credit on its manager and consulting engineer. As to the New Modderfontein, I can only say that the present thoroughly satisfactory results and profits show the real intrinsic value of this great mine. In the central part of this property a circular shaft has been sunk, which struck the reef about six months ago, giving good assay results. This circular shaft is a new departure in Rand practice and is designed to allow for rapidity of hoisting and increased air supply to the underground workings. The Board of this company is now actively developing this portion of the mine, and if a large tonnage can soon be exposed and the values remain as satisfactory as they now are, I expect the directors will have to consider the advisability of materially increasing the stamping power of this concern.

From newspaper reports you will have gathered that there is some talk of an amalgamation or rather absorption of the Robinson Gold Mining Company by the Crown Mines, Limited. Now, the fact of the matter is that nothing definite has, as yet, come before the respective boards, but we have been approached by outside parties, both here and in France, who are largely interested in these Companies to consider such a proposal. I do not at this moment know how the directors of these Companies view such an arrangement, but I do not hesitate to say that, provided a basis fair to both sides can be established, such an amalgamation would prove satisfactory to the shareholders of both Com-

panies. The Robinson has, as you all know, a limited life, but considering that this Company has been so important a factor in the development of the Rand and that it has produced so far something like £17,500,000 and paid out in dividends nearly £10,000,000, it would be a satisfaction to everybody concerned if the shareholders could be assured of a further long-lived interest in a producing and dividend-paying mine.

Before leaving the Witwatersrand mines, I wish to refer briefly to the unfortunately ever-recurring subject of Miners' Pthisis. In February last year, the Government, in conjunction with the Johannesburg Chamber of Mines, appointed a Committee to enquire into and report on ways and means for the prevention of this disease. This Committee has so far issued one report, which recommends the liberal use of water in the underground works to allay the dust. I believe that greatly improved conditions prevail in this respect since the issue of the report.

In August of last year the Miners' Pthisis Act of 1912 came into force. It provides for medical examination of miners and for compensation to those men who have contracted the disease. When applying for work underground, men have to be medically examined and, if quite sound and healthy, can take up their work, whilst those already suffering from the disease receive compensation. Compensation is also given to the widows and children of those miners who have died from the disease. It is to be hoped that the combined efforts now being made to overcome this great evil will bring about such a condition that miners' pthisis will become a thing of the past.

To sum up, the past year's work on the Rand, in so far as our Group of Mines is concerned, has been to a great extent the completion and operating of the innovations introduced during the last three years, and which I mentioned when addressing you last year. The current year should give further proof of the various means adopted, by improved efficiency, reduced working costs and increased profits—the result of the general reorganization, introduction of power plants, invention of labour-saving devices, remodelling of underground lay-out and mechanical transport arrangements, ventilation and improved health conditions.

The whole Rand has produced up till now something like £347,000,000 and paid out in dividends more than £88,000,000.

The attitude of the Union Government towards the Mining Industry gives little reason for complaint. True an inclination to place more burdens upon the industry remains and has to be combated as far as possible. Shareholders both in Europe and in South Africa, however, rightly complain of the withholding from them of their legitimate right to 50% of the Bewaarplaatsen proceeds. Large sums of money have been invested in these Bewaarplaatsen in consequence of the legislation passed many years ago and confirmed by the Commission appointed by the Transvaal Government to consider and report upon this matter, namely, that the proceeds of the sale of these claims should be shared equally by the Government and the freeholders. The action of the Government in not finally settling this question in the only possible way, shakes the confidence of investors, and personally I am inclined to think contributed to some extent to the regrettable failure of the recent Union Government issue.

I am also inclined to believe that the Union Government has not fully realised the seriousness of the Water Supply position on the Witwatersrand and has been ill-advised in refusing to accede to the justifiable demands of the community to allow available underground supplies in the south west portion of the Rand to be temporarily utilised.

Turning now to some of our other interests, it is pleasant to record that the Corporation's participation in the Diamond Syndicate has again yielded a satisfactory return, and in this connection I wish to state that we acquired last year a substantial holding in the De Beers Company at a comparatively low figure.

Our interests in West Africa consist of holdings in Prestea Block A, Fantu Consolidated Mines, Appantoo Consolidated and the West African Mines, Limited. The development of Prestea Block A continues satisfactory, but it is taking longer to achieve anticipated results than we were advised would be the case, and expenditure has been greatly in excess of original estimates. The difficulties facing the Boards of mining companies generally on the Gold Coast and their managers on the spot are manifold. The climate is tropical and more exacting than that experienced in some other parts of the tropical zone. Staffs have to be repeatedly relieved, with consequent detriment to the steady continuance of operations. Although every effort has been made to tender conditions of life more congenial, it is difficult to attract really good labourers for lengthy periods on the Coast. Native labour is inefficient and costly, and, unfortunately, Government have not so far seen their way to meet oft-repeated complaints and are apparently not prepared to meet us on the various questions involved in the coloured labour problem. In fact, the action of the Government has repeatedly made matters worse than they naturally present themselves by the introduction of enactments and regulations which managers consider unnecessary and in many cases inapplicable to the work on hand. Notwithstanding all these drawbacks, I have every confidence that Prestea Block A will in time justify the sanguine

expectations entertained at the time we entered upon the business. All engineers who have studied the mine agree that it is probably one of the finest quartz propositions at present under exploitation and that, once the abnormal difficulties have been overcome and the programme undertaken is completed, results will gradually and materially improve.

The Fanti Consolidated is, as you are aware, largely interested in Prestea Block A, and the fortunes of the two concerns are in a measure linked together.

Reports from the Appantso Consolidated have so far not been particularly encouraging, but the work done is by no means determinative of the possibilities of the property, and judgment must be deferred.

The West African Mines have taken several interests in tin mining in Nigeria, some of which undoubtedly hold out excellent prospects of success.

Your Directors continue to hold a very high opinion of the Magadi Soda Company venture mentioned by me last year. I am informed that the railway is nearing completion, or at least within a comparatively short time it will be sufficiently advanced to allow of construction material for the works at the Lake to be carried by rail to their destination. Some of the material has been despatched from Europe within the last few days in order to be ready at Kidumini for transhipment. Naturally the development of a new industry takes time, more especially when operations have to be carried on at a considerable distance from the centre of control, but allowing for all this, I see no reason why the undertaking should not be highly successful in every respect and fully justify our investment.

You will remember that at the last annual meeting I stated we proposed investigating the possibilities of offering to participate in the development of the oil industry. During the year under review options were acquired on a number of properties in Trinidad and negotiations are proceeding with the Government. You will readily realise that negotiations of this sort take time, but we are now nearing the end and will, I hope, be successful. The Island appears to offer considerable chances for the development of sound business, but as a large majority of the ground consists of Crown Lands and a good many legislative enactments dealing with the possible development of the petroleum industry already exist, it is self-evident that, unless satisfactory terms on the numerous points at issue can be arranged with the Government Departments, it would be a risky business to enter the field. I am afraid the patience of the parties from whom we have taken options has been somewhat tried, but I can assure them that no time has been lost, and I sincerely hope that a final decision will now shortly be reached. If business results, as I hope it will, I do not think there will be any difficulty in finding the comparatively large amounts of money which will be required from time to time for the development of the industry by the Group represented by us in the negotiations.

The properties controlled by the Anglo-Colombian Development Company, Limited, in which we have become interested during the year, are promising of good developments in platinum dredging. Other properties in the Republic of Colombia have been investigated, without, however, any business resulting.

Your Corporation also holds a small interest in a cotton growing Syndicate in the Soudan. This Syndicate has, besides its own extensive property at Zeidab (situate north of Khartoum) carried on cotton growing tests on behalf of the Soudan Government in the country lying between the Blue and the White Niles south of Khartoum. The Imperial Government have shown their appreciation of the possibilities of the Soudan, especially as regards cotton growing, by proposing to Parliament to guarantee a loan of £3,000,000 for the purpose of irrigation and railway extension in that country.

We have taken an interest in a new undertaking in the United States of America, which has for its object the extraction of alcohol from sawdust. The name of the Company, which is just entering the producing stage, is the Standard Alcohol Company.

We are also interested in Natomas Consolidated of California, which is partly a gold dredging and partly a land reclaiming proposition. In both directions this concern is making satisfactory progress.

The vacancy on the Board caused by the death of Sir Julius Wernher has been filled by the election of Mr. M. Francke. This gentleman, whom we gladly welcome as a colleague on our Board, has been connected with the mining industry for a number of years, and has held responsible positions both under the Transvaal Government and with private firms. He is at present on his way to Johannesburg to visit the mines in which we are interested.

Before concluding I wish, on behalf of the Board, to express our hearty thanks to all the officials of the Corporation, both here and in South Africa, for the efficient way in which they have performed their duties. To give a practical proof of recognition, I will ask shareholders to approve of the balance carried forward, £1,500 amongst the staff out of the balance carried forward.

I now formally move that the Report of the Directors and the Statement of Accounts per December 31, 1912, as laid before the meeting, be and they are hereby received and adopted. I will

call upon Mr. Reyersbach to second that.

Mr. L. Reyersbach: Mr. Chairman, as usual, the seconding will only be a formal matter. There is only one thing I should like to mention, and that is that I wish heartily to associate myself with all that has fallen from you regarding the death of our late lamented Chairman, and I would like to point out to the shareholders that Mr. Eckstein was unanimously elected by his colleagues on the board to fill the post which unfortunately became vacant, and I am sure shareholders will agree with me in wishing that Mr. Eckstein may long and successfully occupy that position. I think that is all I have to say, and I beg formally to second the adoption of the report.

The Chairman having invited questions,

Mr. W. Henning expressed the opinion that it was unusual for directors to send out proxies, and he also asked for an explanation of the item of "allowance to directors in Johannesburg" in the accounts and, referring to the company's assets, suggested that a list of the holdings should be published, as was done in the case of the Rand Mines. He further expressed the desire to have some information with reference to the Magadi Soda Company and its prospects.

General Sir Edmund G. Barrow, G.C.B., also urged that a list of the company's holdings should be published, and suggested that the shares of the Corporation should be divided into shares of £1 each, as this would make them more marketable.

The Chairman: The first question asked was as to proxies. Well, in this connection we do what practically every other financial company in England does. I think our solicitor, who is sitting next to me, will bear me out in saying that it is the usual practice to send proxy forms to the shareholders when the notice of the meeting is circulated. The second point raised was the allowance to directors in Johannesburg. It is customary with all companies who have representatives in foreign countries where the cost of living is very considerably higher than it is here, to make an extra allowance to those living on the spot. I may say that two of our participating directors reside in South Africa. The next point was the question of publishing a list of the assets. In regard to this matter, which was referred to at our last annual meeting, we are entirely in the hands of the shareholders. If a preponderating number of shareholders wish it, we are quite willing to publish details, although as a board we have strong objections to that course. There is a considerable difference between the Rand Mines Co. and ours. The Rand Mines Co. is what I would call a holding company; they deal very little in shares. We are essentially a dealing company; we deal daily in the market, buying and selling, and for this reason I think the board's operations are certainly more unfettered if publication does not take place. But I repeat that if a large section of the shareholders wish it we are ready to comply. We are not afraid to show what we have got, but there is no doubt that it would hamper our operations.

General Sir Edmund G. Barrow: After that observation I beg to withdraw my remarks about the publication of a list of our holdings.

The Chairman: I am very much obliged to you. I will now ask Mr. Reyersbach, who is on the board of the Magadi Soda Company, to tell you when operations are likely to start.

Mr. Reyersbach: The capital of the Magadi Soda Co., speaking from memory, consists of 1,250,000 ordinary shares of £1 each, and 1,250,000 deferred 1s. shares. The ordinary shares get a 10% preferential non-cumulative dividend, and are afterwards entitled to 47½% of any surplus profits. The deferred shares, which really represent the profit made on the financing of the Co., get 47½% of such surplus profits, and the remaining 5% are used in some other way. The company is under Messrs. M. Samuel & Co.'s management. The railway, as the Chairman has already stated, is nearing completion, and, of course, until that railway is through, the works at the lake cannot even be started. How long exactly it is going to take for those works to be erected I do not know—it may be 8, 9, or 10 months; so that if some time towards the middle of next year the company joins the soda producers, I think that will be about what you can reckon upon. As to the profits that are likely to be made, it is a competitive article, and I think it would be very unwise to give any information on the subject; in fact I would not do so without the consent of all my colleagues on that Board. We know that without some difficulty we are not going to get over the competition which exists in the soda trade, and we should be very ill advised to disclose either our expected cost figures or what we expect to make per ton. The only thing I can tell you is that the consumption of soda, soda ash, and soda crystals is constantly going up, that the field is a very great one, and that I do not think the portion of the trade which we wish to enter and which we intend entering, notwithstanding the opposition which we will have to face, will be denied us, but I am not prepared today to say what profits we are likely to make, because the balance sheets of the Magadi Soda Company will have to tell that. Our own interest in that company, reckoning the shares as fully paid, is somewhere in the neighbourhood of £150,000. That, of course, is our total commitment, including uncalled amounts.

The Chairman: With regard to the high nominal value of the

Corporation's shares to which General Barrow has alluded, I may explain that the question of splitting has been under consideration, but it has been decided not to make any change both on account of the high cost involved and in order not to interfere with free dealings on the Paris market, where shares of large nominal value are preferred.

The motion was carried unanimously.

The Chairman: I now beg to move: "That a dividend be declared for the year ended December 31, 1912, upon the issued shares of the Company at the rate of 12s. per share free of Income Tax, and that there be deducted from such dividend the amount of the interim dividend of 6s. per share paid on August 9, 1912, on account thereof, and that such dividend be payable to all shareholders registered on the Transfer Books on April 26, 1913, and to holders of Coupon No. 7 attached to Share Warrants to bearer."

Mr. G. Rouliot: I beg to second that.

The motion was unanimously adopted.

The Chairman: I now move: "That Vicomte G. de Breteuil (who retires by rotation) be and he is hereby re-elected a non-participating director of the company."

Mr. Otto Beit: I will second that with pleasure.

The motion was unanimously agreed to.

The Chairman: I beg further to move: "That Mr. Max Francke who has been appointed to a seat on the Board as from January 1, 1913, and who also retires in accordance with the Articles of Association, be and he is hereby re-elected a non-participating director of the company."

Mr. R. Allatini: I will second that.

The motion was carried unanimously.

The Chairman: I further move: "That this meeting approves the board's proposal to distribute the sum of £1500 by way of bonus amongst the London and Johannesburg staffs, and the board is hereby authorized to carry the same into effect."

Mr. Harry Mosenenthal seconded, and the motion was unanimously adopted.

Mr. Pakenham then proposed and Mr. John Forbes seconded the re-election of the retiring auditors, Messrs. Cooper Brothers & Co., at the same remuneration as before, and this resolution was unanimously adopted.

The Chairman: Gentlemen, that finishes the business, and I thank you for your attendance.

Mr. Mosenenthal: There is one other item for us to deal with as shareholders, and that is to pass a very cordial vote of thanks to the chairman and his colleagues. Before I move this may I be permitted, as perhaps the oldest friend and schoolfellow of the late Sir Julius Wernher, to say how much I was touched by the chairman's and Mr. Keyersbach's feeling remarks on the great loss we have suffered, and to say, on behalf of myself, and, I am quite sure, on behalf of all the shareholders, how thoroughly we associate ourselves with the feeling of loss and sympathy which has been expressed to the surviving relatives. Gentlemen, in life we have to take things as they come, and we have to say, as others have said, "The King is dead! Long live the King!" Sir Julius Wernher is dead, but we welcome in Mr. Eckstein a worthy successor, and we wish him and this great company a long and prosperous life and career. After these few remarks I put it to you that our best thanks are due to the chairman and the directors, and I should like to add that perhaps our special thanks are due to those gentlemen who reside in Johannesburg and whose services are, anyhow, in my opinion, none too highly paid and recognized. I beg to move that resolution.

Mr. W. Asch seconded, and it was carried by acclamation.

The Chairman: Mr. Mosenenthal and gentlemen, on behalf of my colleagues and myself I wish to tender you my sincere thanks for the words you have spoken. It is always gratifying to know one's efforts are appreciated. During the past year we had a very hard time. We had to face the loss of our chairman, and altogether times have been very difficult. Still, we tried to do our best and we will continue to do so in order that we may merit the same approbation next year.

The proceedings then terminated.

THE SAXON TIN & WOLFRAM MINING CO., LTD.

THE statutory meeting of the Saxon Tin and Wolfram Mining Company, Limited, was held on May 8, Mr. O. J. Steinhart presiding.

The Chairman said they had acquired a controlling interest in the Gewerkschaft Zinnwald. The mines were situated in the Saxon Erzgebirge, about thirty-nine miles south of Dresden. Mining had been carried on in that locality for about 400 years. It was probably one of the oldest tin mining centres of the world, and enjoyed a remarkable record. The outstanding features of the enterprise were the existence of large

dumps and also of a considerable quantity of mine-filling, which the old workers had left behind owing to the presence of wolfram. In those days that was not only worthless, but an encumbrance. Modern methods of electro-magnetic separation had, however, overcome the difficulty of treating mixed tin and wolfram ores.

During the year 1911, 8878 tons of crude ore had been treated, giving a return of 86.14 tons of concentrates, while during 1912, 9300 tons had been treated for 87 tons of concentrates. Surveys showed that there were at least 200,000 tons of dump material on the surface, and that the mine-filling amounted to from 50,000 to 100,000 tons. Extensive additions to the crushing and concentration plant were in hand, the directors having arranged that a mill capable of dealing with 160 tons per 10-hour day should be erected. That, with the existing mill, would be equal to 200 tons per day. The large mill should be running by October 1. Their extraction from dump and old mine-filling was between 0.8 to 1%, and their working costs were extremely low, only about 8s. per ton of crude ore. Some of the mines in Cornwall were obtaining a recovery equal to their own, but their costs were from two to three times as high.

Their concentrates were costing them about £44 per ton, and, allowing a gross value of £100 per ton, they had a profit of, roughly, £56 per ton, or, on a basis of 40,000 tons per annum milling capacity, a gross profit of about £20,000 per annum. Deducting standing and other charges, they might count on a net profit of £14,000. The tin market was favourable, while wolfram was finding more extended use every year.

OOREGUM GOLD MINING COMPANY OF INDIA, LTD.

THE ordinary general meeting of the company was held on April 15 at Cannon Street Hotel, E.C., Mr. Malcolm Low, chairman, presiding.

The Chairman said that though the yield for the year was less by 2313 oz. gold, shareholders who had read the report would feel perfectly confident for the future. The result of the year's work was a production of 82,212 oz. gold, worth £347,943, from 145,558 tons of ore. The decrease in yield was not due to any fall in the average content of the ore milled, but to the deliberate policy of the board in reducing the amount of ore sent to the mill during a short time early in the year when the developments were not equal to the accustomed extraction. The profit for the year was £154,534, out of which £120,231 was distributed as dividend, being 40% on the preference shares and 30% on the ordinary shares, exactly the same as for the previous year. In addition, £15,000 had been added to the reserve fund, which now stood at £45,000. The maintenance of the dividend in spite of the reduced output was due to the decrease in the cost of operations. With regard to the future, the recent developments were favourable. At every point in depth they were in profitable ore. Their manager, Mr. R. H. P. Bullen, reported that the general prospects of the mine were more promising than they had been for many years. The shoot developed in the southern part of Oakley's section seemed to be an entirely new make of ore, the discovery of which at such a depth, after sinking through barren ground for over 1000 ft., should be an encouragement to anyone connected with reef mining in India.

The report was unanimously adopted.

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T. A. RICKARD, Editor.

EDGAR RICKARD, Managing Director.

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STATISTICS

STOCKS OF COPPER IN ENGLAND AND THE CONTINENT
Reported by Henry R. Merton & Co. Tons of 2240 lb.

	Mar 31 Tons	April 30 Tons	May 31 Tons
In England	22,527	21,764	20,524
In France	3,514	3,223	3,380
Altogether from Chile	2,200	2,050	1,700
Altogether from Australia	4,000	3,400	4,000
In Rotterdam	5,500	6,200	4,800
In Hamburg	4,863	4,920	3,822
In Bremen	2,150	2,271	1,961
In other European Ports	2,500	2,000	1,501
Total European visible supply	47,574	45,828	41,687

AMERICAN COPPER PRODUCERS' ASSOCIATION'S FIGURES
In Tons of 2240 lb.

	Production		Deliveries		Stocks at end of month
	Total	Domestic	Foreign	Total	
Total, 1911.....	639,258	316,791	337,009	653,800	—
Total, 1912.....	706,052	365,920	333,212	699,132	—
January	64,053	29,111	26,956	56,067	55,000
February	58,400	26,641	32,219	58,860	51,600
March	60,822	34,190	31,682	68,872	46,550
April	60,416	34,892	38,346	73,238	33,728
May	63,088	36,209	30,477	66,686	30,130

PRODUCTION OF GOLD IN THE TRANSVAAL.

Year	Rand		Elsewhere		Total	Value
	Oz.	Oz.	Oz.	Oz.		
Year 1912	8,753,563	370,731	9,124,299	38,757,560		
January 1913	760,981	28,409	789,390	3,353,116		
February	702,394	31,728	734,122	3,118,352		
March	760,324	30,228	790,552	3,358,050		
April	755,858	29,116	784,974	3,334,358		
May	761,349	32,957	794,306	3,373,998		

COST AND PROFIT ON THE RAND.

	Tons	Yield per ton	Cost per ton	Profit per ton	Total profit			
						s.	d.	s.
July 1912.....	2,149,785	28	6	18	8	1,061,089		
August	2,121,455	28	9	18	10	1,055,315		
September	2,081,295	28	7	18	10	1,040,820		
October	2,000,709	28	0	18	3	1,079,334		
November	2,155,690	28	2	18	5	1,059,564		
December	2,218,305	28	0	18	10	1,120,372		
January 1913.....	2,296,948	27	8	18	0	9	1,113,579	
February	2,100,137	27	11	18	3	9	1,019,774	
March	2,321,254	27	5	17	8	9	1,121,786	
April	2,301,099	27	6	17	11	9	7	1,101,099

NATIVES EMPLOYED IN THE TRANSVAAL MINES.

	Gold mines	Coal mines	Diamond mines	Total
April 30, 1912.....	197,137	8,364	13,785	220,086
May 31	193,829	8,460	14,538	216,827
June 30	188,494	8,549	15,530	212,573
July 30	182,925	8,497	15,834	207,256
August 31.....	179,111	8,766	15,934	203,811
September 30.....	180,739	8,773	15,752	205,274
October 31	182,058	8,803	15,496	206,357
November 30.....	186,881	8,767	14,872	210,520
December 31.....	191,316	8,634	14,965	214,915
January 31, 1913.....	200,090	8,789	13,912	222,791
February 28,	207,662	8,877	13,918	230,457
March 31	207,733	9,094	15,041	231,783
April 30	205,424	9,071	15,626	230,103
May 31	197,644	9,662	15,345	222,051

GOLD OUTPUT OF INDIA.

Year	Year 1911	Year 1912	May 1913	Year 1913
£2,150,050	£2,265,094	£190,607	£934,425	

PRODUCTION OF GOLD IN RHODESIA.

MONTH.	1909	1910	1912	1913
	£	£	£	£
January.....	204,666	227,511	214,918	220,776
February	192,497	203,888	209,744	208,744
March	202,157	228,385	215,102	257,797
April	222,700	228,213	221,476	241,098
May.....	225,032	234,888	234,407	
June	217,600	214,709	226,867	
July.....	225,234	195,233	240,514	
August	228,296	191,423	239,077	
September	213,249	178,950	230,573	
October.....	222,653	234,928	230,072	
November.....	236,307	240,573	225,957	
December.....	233,397	199,500	218,661	
Totals	2,623,788	2,568,201	2,707,368	

PRODUCTION OF GOLD IN WEST AFRICA.

MONTH.	1911		1912		1913	
	Oz.	Value	Oz.	Value	Oz.	Value
	£	£	£	£	£	£
January	15,903	66,107	26,098	107,262	34,857	144,262
February	15,179	63,081	25,009	102,270	32,544	137,038
March	16,387	67,673	27,228	111,379	36,289	150,060
April	17,237	70,880	27,790	114,796	35,295	146,220
May	24,427	96,409	28,015	115,678		
June.....	22,555	92,174	27,784	114,697		
July.....	22,510	91,955	30,974	127,800		
August.....	25,385	103,753	33,015	136,407		
September.....	26,717	109,039	34,491	142,397		
October.....	26,826	109,503	34,436	142,414		
November.....	24,289	99,299	33,183	137,709		
December.....	24,369	99,569	34,917	144,382		
	261,784	1,069,442	362,940	1,497,179		

PRODUCTION OF GOLD IN WESTERN AUSTRALIA.

	Export oz.		Mint oz.		Total oz.		Total value £	
Total, 1910	363,496	1,209,856	1,573,352	6,682,042				
Total, 1911	160,021	1,210,447	1,370,468	5,823,522				
Total, 1912	83,539	1,199,080	1,282,669	5,449,057				
January 1913.....	9,738	94,967	104,705	444,756				
February	8,780	92,207	100,987	428,963				
March	754	97,015	97,769	415,294				
April	7,920	103,324	111,244	472,532				
May.....	7,094	103,085	110,179	468,007				

OTHER AUSTRALASIAN GOLD PRODUCTION.

	1911	1912	May 1913	1913 to date
	£	£	£	£
Victoria.....	2,138,000	2,039,400	131,600	716,200
Queensland	1,623,390	1,484,160	99,850	473,900
New South Wales	769,353	702,129	44,036*	201,955*
New Zealand	1,808,049	1,345,115	163,095	599,077

*April figures only.

SALE OF TIN CONCENTRATE AT REHRUTH TICKETINGS.

	Tons	Value	Average
Year 1911	6151½	£702,599	£114 4 5
Year 1912	6492	£831,908	£128 5 6
January 6, 1913	231	£32,764	£141 17 2
January 20,	257½	£36,647	£142 9 1
February 3,	260	£36,221	£138 18 3
February 17,	306½	£32,393	£137 5 2
March 3,	252	£33,251	£131 13 9
March 17,	429	£29,302	£127 19 2
March 31,	258	£34,256	£132 15 6
April 14	317½	£30,512	£140 2 6
April 28	262	£36,327	£138 13 1
May 13	224	£31,315	£139 16 0
May 26	259½	£34,296	£132 3 3

EXPORTS OF TIN AND ORE FROM STRAITS AND BOLIVIA.
Reported by A. Strauss & Co.

	1912 tons	May, 1913 tons	1913 tons
Metal from Straits to Europe and America	59,036	6,075	25,942
Metallic Content from Bolivia to Europe.....	21,149	1,488	9,704

REVIEW OF MINING

INTRODUCTORY.—The settlement of the Balkan question, as far as the relations of the great European powers are concerned, cleared the air in financial circles about the middle of May, whereupon the public was promptly importuned with opportunities for investment. The Chinese loan was an immediate success, but most of the other issues had to rely on their underwriters. Two industrial issues of note were in connection with additional capital required for the firms of Armstrong-Whitworth and Beardmore. The Royal Mail Steam Packet Company offered shares to provide ships in readiness for the opening of the Panama Canal, and other noteworthy issues were the Nitrogen Products and the Chilean Railways. Unfortunately for the market in general, a large number of speculators and members of the Stock Exchange took advantage of the lifting of the war cloud to rearrange or liquidate their commitments, so that instead of a boom we have had a period of nervousness and shaky markets. Mining shares have been depressed and quotations have dropped persistently.

In the metal market, the event of the month has been the drastic reduction in the price of zinc, made by the controlling continental syndicate, from £25. 10s. to £23. For some months the attitude of consumers has been such as to warrant some reduction, though not to so great an extent as this. It is stated that the severe cut has been made in order to discourage the export of American zinc to Europe. Naturally some consternation has been caused among shareholders in the zinc-producing companies. In the copper market, views have been expressed in some quarters that the period of trade prosperity is nearing its end, and shares have suffered. In general engineering and shipbuilding the amount of

new business booked is comparatively small, as is evidenced by fall in the price of iron. But the other large source of demand for copper, the electrical industry, shows no sign of check, especially in Germany. The price of lead continues at a high level, and will afford some compensation for the cut in the price of zinc.

TRANSVAAL.—The output of gold on the Rand during May was 761,349 ounces, the highest figure yet recorded. Outside districts contributed 32,957 ounces, bringing the total for the Transvaal to 794,306 ounces, worth £3,373,998. The number of native labourers shows, as is usual at this time of the year, a decrease, 197,644 being employed at the gold mines on May 31, as compared with 205,424 on April 30 and 207,733 on March 31. The position is a trifle better than on May 31 a year ago when 193,829 were employed.

As indicated in this column last month, the directors of the Cinderelia Consolidated have practically decided to suspend milling until the underground conditions, as far as both hauling and development are concerned, have been improved. The £1 shares are quoted at 6s. 3d. in Johannesburg, an indication of the local feeling as to the immediate future. The May results indicate a loss of £4065.

A circular vertical shaft is to be sunk by the Crown Mines at the western end of the property. It is calculated to cut the 'reef' at a depth of 2000 ft., and it is to be connected with the 13th, or main-haulage, level, which extends all the way from the east to the west boundaries. The chief object in undertaking this work is to improve the underground ventilation. The shaft is to be 18 ft. in diameter, and the design will be similar to that of the shaft at New Modderfontein, recently completed. Sinking will be commenced in July.

City Deep has been the victim of rumours once more, this time in connection with the ventilation. It was alleged that mining and milling were to be suspended until improvements could be made. The chairman, Mr. R.W. Schumacher, at the shareholders' meeting described such rumours as dishonest. He stated that the new circular shaft that is to be sunk, for the express purpose of improving the ventilation, is designed to exhaust 300,000 cubic feet per minute.

The Witwatersrand Gold Mining Co., one of the Barnato group, owning the mine commonly known as Knight's in the middle west Rand, is making an issue of shares for the purpose of developing the deep-level part of the property. The vertical shaft was completed last year, and at first the deposit appeared disappointing. Subsequently the results were much more encouraging, and are considered sufficiently satisfactory to warrant the issue of 42,500 shares at £3. 10s. per share in order to provide capital for the equipment and plant.

The Consolidated Langlaagte has made an issue of £300,000 debentures carrying 5½% interest in order to liquidate the debt to the Johannesburg Consolidated, the Barnato parent company. The money was advanced last year for the development of the ground south of the great dike and for the provision of new metallurgical plant. The new mill contains 100 stamps, each with a duty of 20 tons per day, together with 10 tube-mills. The company has not yet paid a dividend, but judging by the present improved conditions, profits should be made during the current year.

The New Kleinfontein has attracted attention in more than one way during the month. In the first place, the shareholders' meeting was the scene of an acrimonious discussion as to the life of the mine. As we recently recorded, the variations in the results of development have made it necessary to reduce the estimate, and there have been many differences

of opinion with regard to the matter among the technical staff. It was admitted that the late manager did not agree with Mr. E. J. Way, the consulting engineer, and that a private report had been made by an engineer from the East Rand Proprietary. The Chairman, Mr. W. Dalrymple, declined to publish reports not addressed directly to the board of directors. Rumour has it that this private report indicated 8½ years instead of the official 13 years' estimate for the life of the mine. The secrecy maintained by the board has created a bad impression among shareholders. The other incident at Kleinfontein has been a strike due to a dispute with regard to the hours of work. An additional half-hour on Saturday was added by the management so as to bring the total hours per week to forty eight. The dispute has not yet been settled.

The scheme for imposing an export tax of 10 per cent. on uncut diamonds has been discussed for several weeks in South Africa, but the general feeling in government circles is that the time has not yet arrived for such a course. The object was to encourage the establishment of a local diamond-cutting industry. At the present time the authorities in South Africa have not learned enough about the business and art, and in the meantime it is felt that any precipitate action would only dislocate the production and sale of the raw material. In any case the device of fostering the industry by means of the export tax will be abandoned for the time being.

RHODESIA.—The output of gold for April was reported as being worth £241,098, so that the record of £257,797 during March has not been maintained. The decrease appears to be chiefly due to the shorter month's work at the leading mines. The Wanderer, Lonely Reef, and Willoughby's tributors showed slight increases.

The directors of the Globe & Phoenix have agreed to accept a reduction in their fees and extra remuneration. During the past three

years, the money distributed among the members of the board in this way has averaged £15,000 per year, the high figure being due to the percentage of profit allowed by the articles of association. The proposal now is to give £400 per year to each director as fee, with an additional £200 to the chairman; and a maximum extra remuneration of £2000 per year divisible among the members of the board. This will involve altogether a yearly sum of about £5000.

Some perturbation has been caused among shareholders in the Falcon Mines, the company that owns the copper-gold property in the Gwelo district, by the official statement that Mr. A. H. Ackermann, the engineer for the Chartered Company, has expressed doubts as to the correctness of the assay-plans. The control of this company recently passed from the Rhodesia Consolidated to the Consolidated Gold Fields, and the last estimate of the ore reserve was 730,000 tons, averaging 5 dwt. gold and 3% copper. The cable sent from the mine in answer to Mr. Ackermann expresses continued confidence in the sampling results. But the information in connection with this incident is too scanty for any judgment to be passed.

At the annual meeting of Tanganyika Concessions, Mr. Robert Williams was able to show progress in the railway construction that is to develop the resources of central Africa. The development of the copper deposits progresses slowly. A second blast-furnace has been erected, and will be at work directly the coke supply from Rhodesia is adequate and the dressing plant for the ore completed. Mr. Williams was as enthusiastic as ever as to the future, and stated that plans were in hand for the erection of additional furnaces that would increase the output of copper to 36,000 tons per year. The Star of the Congo is still the only mine from which ore is obtained, but the Kambove and Luushia are being developed. The scarcity of labour is causing anxiety.

WEST AFRICA.—The output of gold during April was worth £146,220, as compared with £150,060 during March, the record month. The fall is chiefly due to the decreased output at Ashanti, where the figures were £35,891, instead of the usual £40,000; the scarcity of fuel caused by the strike of wood-cutters is causing great inconvenience. Abbontiakoon has slightly declined, whereas the output at Prestea Block A continues to increase.

The shares in Prestea Block A have been weak owing to the expectation that the scheme for the reduction of the capital from £1,150,000 to £500,000 will be recommended at the forthcoming general meeting.

NIGERIA.—Reports coming from numerous companies indicate that washing-plants are gradually being completed. For instance, Mr. J. M. Iles reports that three sluices out of a contemplated eight are running at the Top property. The Jos Tin Area Company's dredge is in course of construction, the whole of the component parts having been delivered. The rainy season is now due, and the operation of companies working in the river beds will be interrupted.

AUSTRALASIA.—The lode on the 8th level at the South Blocks mine, belonging to the Zinc Corporation, has been proved to be 80 feet wide. Of this distance 50 feet is in ore above the average of the mine, assaying 14'8% lead, 10'7% zinc, and 2'3 ounces silver. The remainder of the ground is streaky, but the probability is that it will all be worth extracting. The Sunny Corner mine, mentioned last month, has been floated as a subsidiary, the name of the company being 'Zinc No. 1.'

The long-expected lawsuit against the Golden Horse-Shoe company for infringement of the Sulman-Teed and other patents relating to the use of bromo-cyanogen has been commenced at Perth. Much evidence was taken on commission last year in this country in connection with the case. All the other Kalgoorlie mines have been paying

royalty to the owners of the patents. The defendants rely on the work of Dr. W. H. Gaze, of New Zealand, who, by the way, published an excellent book on the cyanide process that received too little attention elsewhere.

According to the latest cable from Mount Lyell, the North Lyell has been unwatered, and it is expected that the output will regain its normal proportions about the end of June.

According to cable information, resumption of smelting at Great Cobar was expected on June 2, on the arrival of the necessary supplies of coke. Another cable announced the recurrence of the old creep at the southern end of the central orebody. Much comment is current here and in Australia on the absence of the full information expected from big enterprises of this kind.

Labour troubles have arisen in the Cloncurry district, Queensland, owing to the Miners' Union demanding the abolition of contract work. The mine owners consider this an impossible request. In consequence operations at the Hampden Cloncurry and the Mount Elliott have been suspended.

The Yuanmi company reports that, owing to unprecedented rains, the sulphide plant cannot be completed before the end of August. As the amount of oxidized ore is limited, the output has been reduced in the meantime.

A rumour was circulated in Australia to the effect that an interest in the Mount Cuthbert copper mine had been acquired by the Mount Elliott company. Mr. W. H. Corbould's visit to the Mount Cuthbert apparently gave rise to this erroneous idea. Mr. Corbould is not now general manager of the Mount Elliott, though he is still consulting engineer, and his visit to Mount Cuthbert was undertaken in an entirely separate capacity.

MALAY STATES.—The news published by Malay tin companies this month is uniformly satisfactory. The Tronoh is to install a bucket-dredge and a suction-pump dredge on one part of the property, and the Tekka is to sub-

stitute a bucket-dredge for the suction-pump dredge at its mine in the Taiping district. The Lahat company has acquired additional ground in the direction of the granite hills to the west. All three companies have paid excellent dividends recently.

As announced in our February issue, the Renong Dredging Company, operating tin gravel properties in the Western Siamese States, near the border of Burma, has made a great success with the dredge erected in 1910. Additional tracts of country have been acquired and two new dredges have been ordered. In order to provide funds, the company has been reconstructed, and 22,107 shares offered for subscription to shareholders at 25 shillings each. Out of the profits earned during the financial year that commenced on October 1, £12,267 is being paid as dividend and £13,000 allocated to capital expenditure. The estimates of the tin contents of the alluvium and of the cost indicate a profit of £50,000 per year when all three dredges are at work.

The Siamese Tin Syndicate, working in the Renong district, reports that its dredge has re-commenced work, and that the first of the two new dredges has been dispatched from Glasgow and is due to arrive in August.

CANADA.—The Kirkland Lake district is now the centre of attraction among prospectors in Ontario. This district is near Swastika and is about equidistant from Cobalt and Porcupine. The reason for this attention is the richness of the ore extracted from the Foster-Tough claims. Three shipments of ore totalling 73 tons have averaged over 21 ounces of gold per ton.

Prospectors have also gone to Cartier, near Sudbury, owing to reports of the discovery of gold placers, but the information so far received is meagre.

The Tyee Copper Company, owning the smelter on Vancouver island, has made a contract for the purchase of ore from the Ptar-

migan mines, which have recently been acquired by an English company. Mr. H. H. Johnston has proceeded from England to British Columbia to undertake the management of these mines.

The results obtained at the Britannia copper mine in British Columbia with the Minerals Separation process are remarkably good. The ore, which consists of chalcopyrite and pyrite, averages 5.5% copper; the concentrate obtained contains 22%, and 0.2% is left in the tailing. The first unit now in course of erection has a capacity of 600 tons per day.

UNITED STATES.—Our San Francisco correspondent gives a timely analysis of the cost of operations at the 'porphyry' copper mines. The results for 1912 show that the cost varied from 7.69 cents per pound at Chino to 9.83 cents at Ray; the other figures being 8.33 cents at Nevada Consolidated, 9.02 cents at Utah Copper, and 9.58 cents at Miami. It is thus clear that the cost is higher than originally estimated by fully one cent.

MEXICO.—Reports from New York indicate that the financial houses are taking a favourable view of the stability of the Huerta-Diaz government. Already they have floated in America and Europe £6,000,000 in bonds for the purpose of re-organizing the National Railways, and if all goes well this will be followed by a government loan. As regards the condition of the country, reports are as usual contradictory, and it is evident that there is still much unrest in the northern states.

The shares of the Socorro Gold & Silver Mine, Ltd., have been introduced on the Stock Exchange. This company owns a mine near Tegucigalpa, Honduras, that has been worked in a small way by local owners for a long time. Silver is the chief metal. Mr. E. Mackay Heriot estimated the reserve at 300,000 tons averaging 50 ounces per ton. Mr. J. E. Breakell is the manager.

INDIA.—The Hutti (Nizam's) mine continues to develop well in depth. At first the

results on the 2140-ft. level were disappointing, but the latest news is that the face of the drift is in ore averaging $1\frac{1}{2}$ ounces over a width of 5 feet. In the Kolar district the chief item of interest is the continued excellent developments in the deep levels of the Champion Reef.

We regret to note that the Mangalore gold mine, in the Raichor district of Hyderabad, has proved a failure. This property was acquired from the Hyderabad Deccan Company in 1905, and a company called the Deccan Gold Fields Development Co. was formed to work it. The results were discouraging, and a year ago the services of John Taylor & Sons were engaged in the hopes that something could be done. They were unable to find much ore, so the company has been dissolved.

The gold mines in the Shimoga district of Madras, owned by the New Shimoga and Kadur Shimoga companies, are to be amalgamated and further capital subscribed. The latter company is in the control of the Eastern Syndicate, a company with strong Anglo-Indian connections, and having as directors Sir Richard Temple and Sir H. C. King.

SPAIN.—Labour troubles continue at the Rio Tinto mine, and the shares of this company have suffered considerably owing to French selling.

Dredging commenced at the Spanish Gold-fields' property at the end of May, but was shortly afterward suspended pending the raising of the water-level by means of a dam so as to facilitate the handling of the dredge.

CORNWALL.—The tin-sand of Carnon valley, one of the branches of Falmouth harbour, has passed into the hands of the Lempriere-Baillieu group, controlling the Cornwall Tailings Company, which is re-working the Carn Brea & Tincroft dumps, and a company has been formed to work it, entitled the Carnon Valley (Cornwall) Limited. The sand is to be raised by suction-pump and stacked for re-treatment. The question of erecting a bucket-dredge is also being considered.

EDITORIAL

READERS of this magazine are requested to note that copies of the issues of October 1909, January 1910, March 1910, June 1910, and June 1911, are wanted to complete bound volumes. Those who do not care to bind their copies of the magazine and would like either to receive half-a-crown for such copies as have been specified or to do a kindness to a fellow-engineer, are cordially invited to search among their papers on the chance of finding what others need.

THE FORTIETH annual dinner of the old students of the Royal School of Mines was held at the Cafe Monico on June 9, with Mr. Frank Merricks in the chair. The toast of the evening was proposed in most engaging terms by Mr. W. H. Trewartha-James, and it received an effective response from Mr. Merricks, who, incidentally, ridiculed the report of the last Royal Commission on educational affairs, especially in connection with the further merging of the Royal School of Mines with the University of London. Mr. E. A. Ridsdale, an accomplished speaker, proposed the toast of the 'Guests,' to which Mr. R. Newton Crane, seconded by Mr. A. Chester Beatty, made amusing replies. The final toast—to the Chairman—was proposed by Mr. T. Kirke Rose, and was received with an enthusiasm that vented itself both in song and cheers.

THE COPPER HANDBOOK will in future be controlled and edited by Mr. Walter Harvey Weed, who has purchased the copyright, and goodwill from the executors of the late Horace J. Stevens, the founder of this useful book of reference. Mr. Weed is a leading authority on ore deposits, and has specialized on copper. He did much useful

work in this connection for the United States Geological Survey. His 'Copper Mines of the World' and his translation of Beck's 'Nature of Ore Deposits' have won him repute as an author. Under his guidance the 'Copper Handbook' should gain in authority and interest.

THE MAY issue of the magazine suffered by one of those lapses of judgment from which even the best regulated firms of printers are not immune. In the first copies issued from the press, page 362 did not form part of the article on 'Cassiterite in Soil,' but was taken from an article on China, which, by the way, appears in the current issue. It happened that these interchanged pages were both the fourth of the respective articles, and in the printers' shelves the pages of type carried the heading '4.' Moreover, both articles were concerned with eastern mining problems, and the two pages had many points of resemblance typographically. That is the reason for the error, but we and our printers are aware that a 'reason' is not the same thing as an 'excuse.' The error was rectified as soon as discovered, and the majority of the copies issued did not contain this flaw in the make-up. Duplicate copies of the sheet containing pages 361 and 362 were immediately issued to those subscribers who received the imperfect copies. In case some of our readers have purchased imperfect copies at bookstalls, we take this opportunity of inviting them to make application for this substituted sheet.

THE prosecuting counsel in one of the series of proceedings against the militant suffragettes pointed the finger of scorn at the analytical chemist who had provided the dangerous weapons of attack, and expressed his

surprise that an educated man should so prostitute his talents as to lend aid to the campaign against life and property. Probably this was only a forensic flourish, but we take it seriously. We would extend its application. The world's civilization is so little advanced that the power to wreck another nation's life and property is the final factor in deciding between right and wrong. The Suffragettes and their scientist erred against humanity in a microscopic degree as compared with the governments, who ask for death-dealing weapons, and invite the highest talents in the world to invent such things as cordite and lyddite, armour-piercing projectiles and the guns wherewith to throw them.

THE MINING Machinery Exhibition at the Royal Agricultural Hall closed on Saturday, June 7. The exhibits appealed more directly to those interested in coal mines, but, as we have contended before, the managers of metal mines have much to learn from colliery engineers in connection with the economical production and transmission of power. Now that depths are increasing, and wages bills mounting, economy of power becomes more important every day. The generation of power has been made much cheaper by the use of the steam-turbine, and by the utilization of exhaust steam in the low-pressure turbine. In the transmission of power, the steel chain as a substitute for leather belting deserves special attention. It should prove serviceable in stamp-mills and concentration plants. We are pleased to say that the exhibition proved a success in every way, and that all our friends who visited it expressed great satisfaction.

REPORTS by South African companies have for some time used a term 'milling tons,' the meaning of which is not clear to those unacquainted with local practice. We are glad to see therefore that several of the

controlling houses have recently announced the abandonment of this method of estimating ore reserves. The term signified the amount of ore that would eventually find its way to the mill after passing through the sorting-house, and the figure was obtained by dividing the actual tons by a factor based on the proportion of waste removed. As this factor was purely arbitrary, and never coincided with the results in practice, its use indicated a policy of fictitious precision. In successive years the percentage of waste rejected varies at all mines and at some within wide ranges. In the low-grade mines in the middle east Rand sorting is comparatively ineffective and in many cases has been abandoned, whereas the tendency has been in the opposite direction where the ore is in the form of a rich leader. In future, the reserves are to be quoted in 'mining' tons, that is the ore to be raised to the surface.

THE completed tin-dressing plant at Rooiberg, in the north of the Transvaal, has been running for six months, and the recovery is stated to be 88 per cent. Our contemporary, the *South African Mining Journal*, is inclined to use this result as a stick wherewith to belabour the Cornish recovery of only 60 to 70 per cent. Comparisons between bare figures often afford incorrect conclusions. In this case it is not so much the skill displayed in the design of the plant that is to be credited with the high percentage of recovery, as the nature of the ore. The average content is 150 pounds of black tin per ton, and a large proportion of this is sufficiently coarse to be caught in jigs. If this product is omitted from the calculation, the loss of 20 pounds of black tin per ton of ore would loom proportionately larger. There are several rich mines in Bolivia where the percentage of recovery is equally high. It is probable that in the early days at Carn Brea the recovery was nearly as good; but the outside critic looks at

the stacks of tailing from a different point of view nowadays, and sarcastically refers to the 20 pounds of black tin left in that tailing. So a Cornish manager may be excused if he remarks about that 20 pound loss at Rooiberg, and asks whether it could not be reduced.

THE GOLD MINES in central Wales have suffered unenviable notoriety this month by having been dragged into the Marconi libels. These mines have afforded disappointing results for a century, owing to the great variation in the width of the orebodies and the erratic distribution of the valuable metal. Twenty-five years ago Mr. Pritchard Morgan came home from Australia and tried, but vainly, to teach the old country how to develop its resources. From 1898 onward Mr. Godfrey Isaacs worked hard at development, with the result that the reserve and prospects were sufficiently satisfactory to induce the late William Keswick, a partner in Matheson & Co., acting under the advice of Mr. E. T. McCarthy, to provide £40,000 capital for plant and further exploration. This sum was secured by debentures, and was soon returned out of profits. Unfortunately the profitable ore eventually came to an end once more, and for the last five or six years nothing has been done. We need not enlarge on the Marconi libels in general, for our readers are probably tired of them. We would, however, say that the bearing in the witness-box of the mining engineers on the two sides went far to decide the case. For the plaintiff, Mr. McCarthy, with dignified manner, said that while he had been connected with the St. David's Mining Company as consulting engineer, he had never seen anything in connection with the direction of affairs that savoured of doubtful propriety. On the other side, Mr. A. A. Lockwood exhibited a vindictiveness against Mr. Isaacs, and indulged in the wild language of the 'back of beyond,' that together vitiated the acceptableness of his evidence.

IN OUR LAST issue we announced that the *Mining and Scientific Press* had opened an editorial office in New York, under the charge of Mr. Thomas T. Read, Associate Editor. We reproduce a view of the Woolworth building, where Mr. Read is to be found



The Woolworth Building, New York.

on the 13th floor, comparatively near the street. Here also are the New York headquarters of *The Mining Magazine*. The Woolworth is the latest in skyscrapers. It is situated on Broadway between Park Place and Barclay Street. The height above the roadway is 790 feet and the foundations are on the solid rock 121 feet below.

Labour Conditions on the Rand.

During the last two months the health of the underground worker on the Rand, both white and native, has once more been predominant. The unfitness of the native brought from the tropics has for some time been a matter of common knowledge, and probably the controllers of the mines are not sorry that the Union Government has decided to prohibit the recruiting of this type of labour. But their case is as nothing when compared with that of the white miner. The publication of the first half-yearly report of the Miners' Phthisis Board has served to prove that the ravages of this disease are even more widespread than was supposed by the Commission appointed two years ago, when it was shown that over 30% of the white miners on the Rand were affected in a greater or less degree. Our Johannesburg correspondent last month gave an outline of this report, and in our discussion column this month, Mr. E. J. Moynihan, to whom is due no small share of the credit for the appointment of the Commission, makes an eloquent appeal for a thorough revision of the underground conditions in order to put a stop to what practically amounts to wholesale slaughter. If South Africa were still controlled from Downing Street, we should doubtless see an agitation in this country, similar to that in connection with the importation of Chinese labour. The circumstances are at present more serious, for instead of an alleged slavery, we now have undisputed death. And it is not only the miners that succumb to the disease; the managers are victims also. Only recently three well known leaders on the Rand have gone to an early grave. One of them, Tom Johnson, came from Lancashire, where he was a colliery manager, and on the Rand he was manager of Rose Deep and South Nourse successively. The second, Martin H. Coombe, was a New Zealander, and spent his childhood's days in the Thames goldfield. His last

post on the Rand was the managership of the Government Gold Mining Areas. The third, F. A. Bristol, a Canadian by birth, after serving for fifteen years with the Consolidated Gold Fields as manager of the Robinson Deep, Knights Deep, and Jupiter, retired to a Californian health resort, but without avail. We have given these three cases to show that men from all parts of the world are claimed as victims by the dust in the mines of the Rand. Other managers and employees have prudently withdrawn before it was too late, and have either taken to farming or have gone to other mining districts where the risks to health are not so great. We know also that the inclination of the college graduate to adopt metallurgy rather than mining as his special study is not due wholly to a natural dislike of the rough work below ground. We believe the Union Government will take active steps before long for the amelioration of conditions. Fewer miners go to the Transvaal from England nowadays, and an increasing proportion of the recruits are young Afrikanders, whose interests would naturally be keenly watched by the Government. The *Rand Daily Mail* is lending its aid in the agitation, and Dr. J. L. Aymard is only second to Mr. Moynihan in individual effort. The blame for the present state of affairs may be thrown on the necessity for increasing the total output and the output per man, in order to maintain the profit on the poorer ore at greater depth. Many practical suggestions are being made in relation to the management of the mines for the purpose of ameliorating the conditions. At the Wolhuter a great improvement has been made by blasting only once a day, and many are in favour of adopting this plan generally, supplemented by the substitution of electric ignition, controlling all the workings of a mine from the surface. It is generally admitted that a greater length of time must be allowed to elapse after blasting, so that the dust particles may settle before the men re-

turn to work. Dr. Aymard holds that the flannel respirator should be made compulsory, and that until such a regulation is introduced the mine managers and others in authority should set the correct example by wearing it whenever they are underground. However, we need not elaborate on these details of management. All we can do is to urge the big houses to press forward as rapidly as possible the reforms required, in order that the conditions of labour shall not become a reproach to the honourable industry of mining.

Nipissing.

To paraphrase a famous saying of a bygone age, "Ever cometh something new from Nipissing." This celebrated silver mine at Cobalt, Ontario, has indeed provided many novel features. It is not ten years since the building of a railway disclosed the wonderful network of rich veins carrying silver, arsenic, cobalt, nickel, and copper. Of all the groups of claims in that district the Nipissing is the most extensive, and its output of silver is the largest. From the commencement of operations in 1904 to the end of 1912, no less than 27,741,248 ounces of silver had been produced, quite two-thirds of it from ore averaging 1500 ounces per ton, and during the same time 10,168,297 dollars had been distributed as dividends. Moreover, the proved reserves are estimated to contain nearly 10 million ounces, and there remains much ground not yet explored. As a property the Nipissing is sufficiently remarkable, but the methods of mining and metallurgy have provided equally interesting items of news. For instance, surface prospecting is no longer done entirely by trenching, but by the removal of the overburden by hydraulicking, thus exposing the entire surface of the rock-formation. This application of hydraulic jets is not absolutely novel, for it is employed by the Caucasus Copper Company, but the information as to the methods is more accessible to outsiders at

Cobalt than in the Caucasus, and for that reason the installation is of more interest to the average engineer.

The metallurgical problem at Cobalt was naturally a difficult one, owing to the complexity and unusual nature of the ore. In spite of laborious research, the mine-owners had to be content to sell their products to the smelters and make the best bargain they could, until Mr. Charles Butters and his staff, notable among whom were Messrs. G. H. Clevenger, James Johnston, and J. J. Denny, came upon the scene at Nipissing two years ago. As the result of research, a novel plan was adopted, based upon the idea of barrel-amalgamation. Though this process has already been described in our columns, it is opportune to mention that the high-grade ore, averaging 1500 to 2000 ounces per ton, is placed in a closed tube-mill with a large excess of mercury, together with a 5% solution of cyanide. The mercury catches 97% of the silver, while a large part of the remainder, representing 20 to 30 ounces per ton of ore, is dissolved by the cyanide. The process is cheap to operate, and the percentage of recovery is high, two factors greatly in favour of the mine-owner; and, of course, any process worked on the spot has the advantage of eliminating that constant source of error and dispute, the sampling of a high-grade ore. It should be added that a contract has been arranged for the sale of the residue for its cobalt content. In addition to high-grade ore, the mine produces large amounts of ore averaging 20 to 30 ounces of silver per ton. Five years ago a concentrator was built, and the resulting product was sold to the smelters. The success of the high-grade mill, however, and the experience gained in connection with the cyanidation of the ore, prompted the owners to adopt cyanidation in place of concentration. The plant for this purpose, called the 'low-grade mill,' was completed in November, and was in full working order in January. It contains 40 stamps,

weighing 1500 pounds each, and 4 tube-mills measuring 6 by 20 feet. Six Dorr classifiers are arranged in a closed circuit with the tube-mills, and the ore is slimed before being sent to the cyanide plant. It will be seen that there is no amalgamation, and it is well to mention that the reason why cyaniding is done direct on the ore, instead of the ore being concentrated and treated on the system adopted for the high-grade ore, is that in concentration 20 per cent of the silver content is lost. We may add that, in connection with the low-grade mill, a new process is under trial, having for its object the rendering of the combined silver of the refractory ore amenable to cyanide treatment.

We come now to a consideration of the latest metallurgical innovation at Nipissing: the substitution of aluminium dust for zinc dust in the precipitation of the silver from the cyanide solution. The high-grade mill was equipped with the standard Merrill precipitation press, but before it was brought into use, laboratory experiments showed that the cyanide solution lost much of its dissolving power after the precipitation of the silver, and became rapidly worse after successive cycles of operations. Investigation showed that the deterioration was due to the accumulation of zinc in the solution and the concurrent presence of arsenic. Aluminium dust was substituted with remarkably gratifying results. In the earlier days of the cyanide process, aluminium plates had been employed tentatively as the precipitating agent, and Moldenhauer had drawn attention to the advantage due to the fact that aluminium forms no compound with cyanogen, so that the whole of the cyanogen can be recovered. Julian made experiments with aluminium plates, and subsequently shavings, but abandoned them because their surface soon began to lose efficiency owing to the accumulation of alumina. It was not until two years ago that Mr. Stafford F. Kirkpatrick tried aluminium dust at the

Deloro smelter, Ontario. Both Mr. Kirkpatrick, at Deloro, and Mr. E. M. Hamilton, at Nipissing, experienced difficulties at first in bringing the dust into thorough contact with the solution, but these were gradually removed. As aluminium does not combine with cyanogen it is necessary to add caustic soda or other alkali so as to effect the precipitation. In considering the relative advantages of zinc and aluminium from the point of view of both general and special applications, the cost of the materials and the respective quantities required have to be taken into account. At Nipissing aluminium dust is five times as costly as zinc dust, but on the other hand, only one-fifth as much by weight is required. To this item the cost of caustic soda must be added. The total cost of materials may be said to be 30 per cent higher with aluminium than with zinc, but the recovery of cyanide introduces an important saving, and under the conditions obtaining at Nipissing makes the process cheaper. The aluminium reaction has the additional advantage of producing a higher class precipitate, which is easier and cheaper to refine. Whether the new process will be generally preferable to zinc precipitation will depend upon circumstances and conditions, and the subject will form an interesting avenue for research. For silver ores its use will probably be found generally advantageous. The successful application of the process to low-grade gold ores will be affected so much by the ratio of the price and consumption of the two dusts that a trial in each case would be necessary. It is also to be remembered that the amount of cyanide united to the gold is negligible, and consequently the advantage gained by its regeneration would be small. We refer our readers to our 'Précis of Technology,' where an abstract of a paper by Mr. Hamilton, published in the *Engineering & Mining Journal*, on the results at Nipissing, is given, but the paper should be read in full, for it is a model of lucidity and completeness.

Kinta.

Among the successful manifestations of British enterprise in mining we may count the group of tin properties in the Malay peninsula. The names of the Tronoh, Gopeng, Kinta, Tekka, Situpoh, Lahat, and Pusing Bahru are well known from Camborne to Singapore, from London to Kuala Lumpur. It is fitting therefore that the technology of the subject should be enriched at this time by a report on the economic geology of the Kinta district, an area of 726 square miles, in which are situated the group of mines so honourably prominent. This report, just issued by the government of the Federated Malay States, has been prepared by Mr. J. B. Scrivenor, the author of an earlier report on Pahang, and a geologist of whose acumen we have heard from time to time. Not without justification apparently, for this bulletin on Kinta confirms a growing reputation. Anybody interested in the geology of tin deposits, especially in the Malay States, will find in this report a notable accession to current knowledge. Mr. Scrivenor appears to have put himself on a friendly footing with the miner and those in technical charge of the mines, not only in manner but in mind. He acknowledges readily the facilities for observation afforded by the mine workings and the assistance volunteered by the mine managers. He is not one of those top-lofty Government Geologists who utilize the pioneer work of the mining engineer only to criticize small inaccuracies, nor is he the sort of scientific man that makes his investigation in calm disregard of the economic problems involved in the commercial extraction of metals from ore deposits. We detect in his report a keen feeling of co-operation with those who are directing the work of mining, and a proper appreciation of the function of geology as a scientific aid to an important industry.

The Kinta valley is a trough with sides of Carboniferous limestone, flanked by younger granite hills; but the rugged floor of limestone

is covered, in large part, by beds of hardened clay and sand, constituting the shale and quartzite of the Gondwana series, all older than the granite. Covering these older sediments are large patches of recent alluvium, which also fills hollows in the limestone where it has been denuded. In all of these terrains the presence of tin has been proved. The Kinta is essentially a tin district. It remained for the geologist to tell the miner in which of these diverse rocks he might expect to find the largest concentration of metallic ore, and under what structural conditions. This Mr. Scrivenor has done.

The bedrock of limestone is found under the shale and quartzite. Indeed, the limestone is the principal topographic feature, for it has survived in the form of precipitous masses of singular appearance, the origin of which has been much disputed. Mr. Scrivenor imputes the queer topography to block-faulting on a large scale, caused by the eruption of the granite, which broke through the limestone and the Gondwana series of shales, phyllites, and quartzites, fracturing the limestone into blocks, some of which were engulfed within the granitic magma while others slipped into the places they now occupy. This period of plutonic activity was followed by the emission of vapours and thermal waters bearing the tin, with which all the sedimentary formations, and even parts of the cooling granite, were variously impregnated. Thus the precipitous limestone hills of the Kinta valley are blocks of the crust that sank relatively less than the surrounding rocks. The sequel is erosion. The Malay peninsula is an area of uplift; the sea is receding relatively to the land. Therefore the gradient of the rivers has tended to increase, causing continuous erosion of the valley-floor, exposing to view the blocks of limestone and cutting deeply into the covering of shale and quartzite. These—the Gondwana series—at their base show a boulder-clay, which, despite conflicting evidence, is

believed to be of glacial origin. In the clay are found pieces of detrital tin ore, older than the granite of the neighbouring Kledang ranges. This is a fact important to the prospector. In cups of the limestone are the layers of tin-bearing clay so characteristic of these Malay mines. A thickness of as much as 200 feet has been noted at the Gopeng. Owing to their composition, these deposits of ore require vigorous puddling before the tinstone can be separated. The grains of disseminated mineral have worn edges, and occasionally the miner finds lumps of cassiterite large enough to be called boulders. The glacial boulder-clay, like the limestone and the overlying shale or quartzite, is not only metamorphosed at the contact with the granite but is invaded by veins from the granite. This proves the relative youth of the granite, and warrants the interesting conclusion that a period of intense igneous activity was followed, long afterward, of course, by a glacial period. Geology calls for imagination, chiefly as regards the abyss of time in which Nature's operations are performed.

In the Kinta district, tin is found in the clays, both old and recent; it is found in the kaolin veins that proceed from the granite into the limestone and the other sedimentary rocks; it is found in 'pipes' or funicular ore-bodies within the granite; it is found in breccia occupying fault-fissures in the limestone; it is also found in small veins traversing the shale and quartzite. Mineralization is thus manifested in a remarkable diversity of forms. On the other hand, Mr. Scrivenor shows that the talk of 'deep leads,' in the Californian and Australian sense of the term, is not justified. The Tronoh deposit, which, more particularly, has been labelled a 'deep lead,' is a big solution-cavity in limestone filled with boulder-clay, lignite, and sand, in which is found tin both detrital in its origin and also chemical, through the agency of impregnating veins emanating from the granite.

The old idea that the granite of the adjacent hills was the source of all the tin in the Kinta valley must be abandoned, since detrital tin ore of earlier origin has been found in the boulder-clay. But this discovery enlarges the possibilities of mineral exploration; instead of confining his search to the granite margin, the prospector can go farther afield. In the granite he may find those erratic deposits known as 'pipes'; the younger Gondwana rocks are hopeful near the granite mass and near granite intrusions; the recent patches of alluvium are easily mined, but the geologic history of the region renders it likely that such further patches will be scarce; on the whole, therefore, the facts as now known point to the clays at the base of the Gondwana series as the best ground for prospecting. Such work is strikingly facilitated by tropical weathering, whereby all the sedimentary rocks, even the quartzite, are softened to such a degree as to be easily cut by hand-labour. This softening—due largely to the removal of silica by the ground-water—has proved an important factor in the development of the district, rendering easy not only mining but road-making. The country, indeed, is one full of interest, both scientific and economic. That interest will gain much from the publication of Mr. Scrivenor's bulletin. It is an important contribution to economic geology.

Concentrating Oxidized Copper Ores.

In our April issue we discussed the present position of the concentration problem in connection with the copper ores of Arizona, and we touched briefly on the possibility of concentrating oxidized ores by mechanical means. We showed that in many cases jigs and tables can be used for removing as much as possible of the oxidized minerals and we quoted the case of the Arizona Copper Company. As we remarked at the time, metallurgists are apt to accept an inflexible law to the effect that oxidized ores of copper cannot be considered

as amenable to water concentration. Naturally the percentage of recovery can never be high, and in fact the work done can consist only of what the American engineers call 'roughing.' Since the appearance of our article we have received details of the concentration of the oxidized ore at the Arizona Copper Company's mine. These have never been published before, so we take this opportunity of placing before our readers the information kindly sent to us by Mr. Norman Carmichael, the manager for the company. The ore treated at the oxide-concentration plant contains malachite, azurite, cuprite, chrysocolla, copper-pitch (a variety of chrysocolla containing limonite), and brochantite; associated therewith are found also chalcocite, chalcopyrite, and native copper. Of these minerals, malachite is the most important. The chrysocolla is impure and is mostly soluble in dilute sulphuric acid. The chalcocite occurs in small veins and is comparatively pure, but the amount is very small. An average analysis of the ore is as follows: copper $2\frac{1}{2}$ to 3 per cent, silica 59, alumina 12, iron 13, manganese 0.1, lime 1, magnesia 1.2, and sulphur 1. The ore is crushed in rolls, which deliver to a trommel with two sets of holes, $\frac{3}{4}$ inch and $\frac{5}{8}$ inch in diameter respectively, the oversize being re-crushed and returned to the trommel. The oversize of the $\frac{5}{8}$ inch and the undersize of the $\frac{3}{4}$ inch are sent to a 2-compartment Hartz jig, and the undersize of the $\frac{5}{8}$ inch to a Hancock jig. The composition of the concentrate recovered in the Hartz jig is as follows: Copper 20 per cent, silica 27, alumina 45, iron 25, lime 1, and sulphur 5. The concentrate obtained in the Hancock jig and the hutch product from the Hartz jig are sent to Wilfley tables for re-treatment, and the concentrate there obtained has the following composition: copper $9\frac{1}{2}$ per cent, silica 36, alumina 6, iron 24, lime 1, and sulphur $2\frac{1}{2}$. The concentrate is delivered to the blast-furnace department. The specific gravity of the copper minerals in

the concentrate averages from 3.76 to 4.63 for the sizes larger than $\frac{1}{4}$ inch, which constitute 85 per cent of the concentrate. The water from the tailing from both jigs is pumped to settling-ponds, where the slime is allowed to settle and is stored for future treatment. The tailing contains 2 to $2\frac{1}{2}$ per cent copper, and is sent to the leaching plant, where it is treated with sulphuric acid. The ultimate copper content, after leaching, is 0.4 to 0.6 per cent, mostly in the form of insoluble silicates, together with a small proportion of sulphide. It will be seen from the above figures that the concentration amounts to the removal of about 30 per cent of the copper content cheaply, and in a form acceptable to the smelter, thus reducing the duty of the acid in the leaching process. We are glad to have this opportunity to remind our readers that, though we are living in sulphide days, it is still possible to obtain an enriched product from oxidized ores.

Nitrogen from the Air.

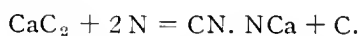
Nitrogen compounds come within the purview of the mining engineer and the metallurgist in many ways. The exploitation of natural deposits of nitrate forms a branch of mining operations. Nitric acid is the basis of manufacture of dynamite and gun-cotton, and ammonia enters into the composition of another class of explosive. The cyanogen group of salts are of prime importance in the metallurgy of gold, and are produced by reactions with ammonia. Nitric acid is used in the parting of bullion, and in many reactions familiar to the assayer and metallurgical chemist. The other great use of nitrogen compounds is in relation to the manufacture of fertilizers, and now that the services of mining engineers and geologists are requisitioned for the discovery and beneficiation of deposits of potash salts, and that superphosphates are by-products at smelting works, the members of our profession must have some

knowledge of this branch of industry also. If ammonia were cheaper, it would have many applications in connection with the hydro-metallurgy of such metals as copper and zinc. Until recently all the nitrogen compounds that are manufactured industrially have been made from nitric acid or ammonia; the former being prepared by the reaction of sulphuric acid on natural salts such as saltpetre and nitrate of soda, and the latter extracted in the form of sulphate of ammonia from the gases resulting from the destructive distillation of coal, either at gasworks, in coke-oven plants, or in blast-furnaces. But during the last ten years many and various processes have been introduced with the object of preparing nitric acid and ammonia from atmospheric nitrogen, and already several of them have become established successes on a large scale.

The two chief processes are those identified with Birkeland & Eyde, and Franck & Caro. In the first-named, the nitrogen and oxygen of the atmosphere are made to combine by passing air through an electric arc. The oxides produced are treated with water for the manufacture of nitric acid. This acid contains a large proportion of water, and this is a disadvantage, because no cheap method exists for concentrating dilute nitric acid. In this connection the nitric acid produced by the Birkeland-Eyde process is not attractive to the maker of nitro-explosives. Its chief commercial application is the manufacture of calcium nitrate, which is put on the market as a fertilizer. As a matter of fact, it is the basic nitrate that is the article of commerce, a modification suggested by Dr. Rudolf Messel to overcome the difficulties presented by the deliquescence of the normal nitrate. It is interesting to note that in former years, before the discovery of the Chilean deposits, the nitrate of lime found as an efflorescence on the walls of stables or other places where organic liquids accumulate was one of the chief raw materials used for the manufacture of salt-

petre. The Birkeland-Eyde factories are all in Norway. The first large factory was erected in 1905 at Notodden, with hydro-electric plant of 45,000 horse-power. Two further installations are now in course of construction at Rjukan, one with 120,000 horse-power, and the other with 140,000 horse-power. The cost of production may be gauged by the fact that it requires $1\frac{3}{4}$ horse-power to make one ton of calcium nitrate per year. Two other types of furnace employing the electric arc are in use in various countries. One of them, invented by Schoenherr, and usually called the 'Badische' process, is installed at Christiansand and Notodden, Norway, and is used for the production of calcium nitrite, a chemical having a wide application in the manufacture of aniline dyes. The other, the Pauling furnace, has been adopted at Gelsenkirchen, Germany, in the Savoy district in the south of France, and at Nitrolee, South Carolina.

The Franck & Caro process consists of the manufacture of cyanamide of lime by heating calcium carbide with nitrogen, according to the formula



The discovery of this compound was made incidentally during investigations conducted with the object of producing cyanide by the reaction of a metallic carbide with nitrogen. The nitrogen gas employed is prepared by the Linde process, which uses the fractional distillation of liquid air. The useful property of cyanamide of lime is that in contact with hot water ammonia is released. It is this property that gives the substance its virtue as a fertilizer. Factories employing this process are numerous, and of them the most interesting to Englishmen are those at Odda in Norway and Alby in Sweden, recently acquired by the Nitrogen Products & Carbide Company, a new company introduced to the public last month under the patronage of Vickers and Nobel's. Others are at work in Italy, Switzerland, Germany, Austria, Japan, and the

United States. In the last-named country, the American Cyanamide Company has factories at Nashville, Tennessee, and at Niagara, while a third is to be erected at Alabama. Cyanamide of lime can be used in the preparation of sodium cyanide, and was used on the spot in the Clancy cyanide process in Colorado, though we believe that this process has been abandoned. The Nitrogen Products company intends to use the Ostwald catalytic process for the conversion of ammonia into nitric acid, and by this means to manufacture nitrate of ammonia. Little has been published recently relating to the Ostwald process, and for this reason the outsiders have suggested as a more feasible policy the combination of the Birkland-Eyde and Franck-Caro processes for the manufacture of nitrate of ammonia. The process is however well known to industrial chemists, who welcome the chance it now receives of being worked on a commercial scale. The fact has been known for nearly a century that if a mixture of ammonia and air is passed over platinum, nitric acid and water are formed, but under the conditions then adopted for working the reaction, the amount of acid obtained was small. Ostwald discovered ten years ago that the efficiency can be greatly increased if the mixture of ammonia and air is driven rapidly over the platinum, and he thereby brought the process within the range of practicability. He found that the nitric acid was not the ultimate result of the catalytic action, but only an intermediate product, and that contact with the platinum must be of the shortest possible duration. Ostwald's process has the advantage over the Birkland-Eyde process in that the nitric acid produced can be more readily concentrated during the cycle of operations, a point of no small importance.

Two other processes for making nitrogen compounds have been brought forward during the last year or two, both of them having claims to serious consideration. One is the

invention of Haber and Rossignol, and consists of submitting a mixture of hydrogen and nitrogen to high temperature and pressure in the presence of a catalytic agent, such as osmium, with the resulting production of ammonia. This process is being developed by the Badische Anilin & Soda Fabrik, which was also responsible for the Schoenherr process already mentioned. The other is the invention of Serpek, and its object is also the production of ammonia. He treats alumina or calcined bauxite at a high temperature with nitrogen, and obtains aluminium nitride, which, when brought into contact with water, yields ammonia and alumina. The nitrogen employed is that present in producer gas, the other constituents of the gas being inactive in the reaction, and having the additional advantage of providing the fuel for the calcination of the bauxite. It will be seen that this process provides not only a means of fixing atmospheric nitrogen, but a method of refining bauxite. The process is being developed in France, and has considerable potential value.

In reviewing the future scope of operations of all these new processes, we have to remember the strong position of the established industries of Chile nitrate and ammonium sulphate. The Chile deposits still have a long life, and, with recent improvements in treatment, vast tracts of hitherto unprofitable deposits can now be exploited on a commercial scale. The production of sulphate of ammonia has no prospective end, for gas will always be a fuel, the gaseous by-products of the blast-furnace will be recovered, and the distillation of coal will be continued indefinitely for the manufacture of coke and the multitudinous organic products from coke-oven gases. We are inclined to think, also, that cyanamide has definite limits in its application as a manure. Its easy release of poisonous compounds makes its use undesirable in the neighbourhood of grazing land, and also in connection with certain root-crops. But we have no desire to

belittle the efforts of the pioneers of the modern nitrogen industry. Every new departure has difficulties to overcome and prejudice to combat. We readily admit that the fixation of atmospheric nitrogen has progressed more rapidly than most new ventures.

The Purpose of Mining.

It is only natural that the ideas current regarding the conduct of mining operations, especially in their financial aspect, should vary widely, for it is evident that no unanimity exists as to the purpose of it all. What is the purpose of mining? To Macaulay's New-Zealander it might appear that mining is a queer business invented to disguise the profitable transfer of mining property from sagacious persons to simpletons; to Wells' Martian, supposing that visitor from Mars to be unfamiliar with similar vagaries on his own planet, the purpose of mining might appear to be the manufacture of counters for gambling on a large scale; to Amundsen's Esquimo, with no previous experience in the complexities of an advanced state of civilization, it would seem as if the business, as conducted in London, were designed to provide a maximum of financial ease at a minimum of responsibility to honourable personages weary of commanding armies or dragooning colonies. To a Cornishman from Camborne it looks like a highly proper scheme for providing suitable employment for deserving mine captains. To a technical gentleman from Westminster it is fairly obvious that the chief merit of mining is that it furnishes appointments and retainers to himself and to others like him, on the education of whom a large amount of time and money has been expended. Finally, a quavering voice, which we recognize as that of a timid and long-suffering shareholder, is heard to ask: "Where do I come in?"

In raising the question, we approach it from the stand-point of modern London, not Dacia, nor even Hungary. As a natural resource or

as a national reserve of wealth, an ore deposit ought to be exploited so as to benefit the State and its citizens as much as possible. Therefore it is claimed by some that the ore should be exhausted with maximum slowness, in order that the operations may employ as many as possible, and the yield be distributed among the largest possible number of citizens. This was the medieval notion of mining as conducted by the governments of Central Europe. The idea that it was more economical to extract a small amount of ore continuously during a long period than to exhaust a mine in a few years, assumed that the beneficiaries did not know how to use their own money fruitfully. It was deemed better for a mine to give employment to a large number of worthy citizens for the time of a generation than to yield great wealth to a few persons in a decade, it being supposed that the latter would consume their dividends in extravagant ways of living or in the acquirement of power hurtful to the commonwealth. This notion is no longer honoured; it is believed that wealth in the form of metallic ore is unproductive while it remains underground, and that it becomes a source of fruitful energy as soon as it is put into circulation as money. We cannot assume that the tin and copper or the lead and silver contained in the orebodies uncovered today will be of service to posterity. The metals needed now in the arts of our present civilization may be superseded in a later period by inventions and adaptations of which we do not dream. To husband these resources may be uneconomical.

In regard to the use of mines as an excuse for gambling, that is not an unmixed evil. We regard it as the exaggeration of a good feature. All mining is speculative. Risk is of the essence of the business. Such risk must be balanced by a compensating gain. To speak of mining as an investment is misleading. Ordinary metal mining, omitting the exploitation of coal or iron, is necessarily

risky. Owing to that risk it is unsuited to investment, which looks to income, taking the safety of the principal for granted; but on account of that very risk it is adapted to speculation, which looks less to dividends than to a rapid enhancement of the principal. Reasonable speculation, with eyes open to the risk involved and the care necessitated, is too often confounded with wild gambling and mere betting on the rise and fall of mining shares, as if they were horses in a race not too scrupulously run. Gambling is not the purpose of mining.

Nor is it meant to provide light labour and a decorative position to retired members of the militant services. The needy noblemen who shed the phosphorescent lustre of a decaying name upon the pages of prospectus and company report are belated anachronisms, telling of a time when mining was more a hippodrome than a business. We are shedding the out-worn humbug of a former period. Even an Esquimo would see the folly of taking an admiral's opinion on a mine or Sandow's judgment on cocoa. The British people have a keen sense of the ridiculous; it is slow to awake, but once awakened it is a powerful instrument for clarifying public opinion. We have nearly reached a time when the director of a mining company is expected to be versed in business and to know something of mining. Once this is postulated, the sinecures for the incapable will be abolished.

As for the idea prevailing among superintendents and engineers, that the prime purpose of the industry is to find them adequate occupation on reasonable terms of payment, this notion will survive a little longer than some of the other fallacies, for it is the one least hurtful to the community of shareholders. Nevertheless, a fallacy it is. Many are the re-constructions and re-organizations of mining companies having no better, and no worse, motive than a continuity of operations ensuring employment to the manager, his staff,

and his employees, without any particular prospect of doing any good whatever to the bank account of the shareholders. Many is the long cross cut that has been driven from the valley into the mountain to intersect a distant lode, which might have been proved by a little shaft-sinking to be quite unworthy of so tedious an effort. Many is the dying mine that has received the oxygen treatment of fresh capital in order to prolong a career that was never likely to be productive, but served to give continuity to a management unwilling to be transplanted.

No; it is for none of these purposes, even the most amiable of them, that holes should be dug in the crust of the earth. The basic purpose of mining is to make money for the owners of a mine. The rest is all frill, accident, and make-believe. Who are the owners? The shareholders, of course. These may include the directors, the manager, the staff, or even some of the wages men; it does not matter what their social status may be, it is for the owners that the entire operation is, or should be, conducted. It is they who, first and last, find money for the enterprise. By shareholders, we do not mean one proprietor more than another. The small shareholder has no greater claim than the big holder. Even the smallest has no right to demand a policy more favourable to him than to those that hold big blocks of stock. No; the purpose of mining is, or should be, to extract the metal in a given orebody in such a way as to yield a maximum amount of money to the whole proprietary. When that is done it will be more advantageous to become one of them, it will be easier to raise money for similar performances, it will be possible automatically to shed most of the anomalies and absurdities that now make mining a comedy of misunderstanding, a burlesque of legitimate industry, and only rarely a serious and scientific effort to utilize a natural resource to the maximum benefit of the community.

SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

SAN FRANCISCO.

Copper producers have had much to say in recent years of an impending 'copper famine,' but those who are detached from the market see less to fear. For one thing events prove that production from the 'porphyry' coppers is by no means to be as cheaply accomplished as was announced in the first flush of success. Annual reports of most of the great 'porphyry' companies for 1912 are now available, and, without important exception,

further expansion of the scale of operations. Apart from the risk as to the investment, the heavy interest charge forces production and decreases the independence of the operator. Attention is being turned instead to improvement in treatment. It has long been known that tailing losses at all the copper concentrators are large, and much money and energy have been spent in trying to decrease them. Improvement is apparently at hand from two sources: (a) development of leaching pro-



ELY, NEVADA.

they confess to costs higher than have been usually quoted. The cost for the Utah Copper Co. is placed by D. C. Jackling at 9'02+ c. per lb. for the year, ranging from 7'707 c. to 14'830 c. per quarter, according to the tonnage treated. The high cost is for the quarter when operations were affected by the strike. At Ray the cost was 9'83 c.; at Chino 7'69 c.; at Nevada Consolidated, 8'33 c.; at Miami, 9'58 c. A recent estimate of probable performance, based upon studies of 26 leading American companies, indicates that the bulk of the copper produced in 1912 will cost 9'39 c. per lb. This cost leaves so much narrower margin of profit than had been anticipated, that there is, by so much, a less incentive to rush production and exhaust the mines. It is apparent that there is little to be gained by

cesses for the carbonate ores, and (b) flotation of the sulphides. At Butte, in particular, tests have been made on various leaching processes. It was announced in May that the Bradley process, made famous by Thomas W. Lawson, had been abandoned, and that the Laust process is to be adopted. The Bradley process, invented by C. S. Bradley, and first planned to be used at the Santa Rita (now Chino) mine in New Mexico, was ingenious from both chemical and mechanical standpoints. As it is not likely to be again brought forward it is scarcely worth while to review it in detail. [A description of the process will be found in our issue of April 1912.—EDITOR]. The individual steps were sound enough, but in operation it required simultaneous use of unusual methods and unusual

machinery, and the close co-ordination of plant and process which is in practice most difficult to attain. The Laust process harks back to standard methods. It was developed by Frederick Laust, the superintendent at Anaconda, and is designed to treat the tailing from the wet concentration plant. This contains 0.65% copper and is to be dewatered, roasted in furnaces of McDougal type, the product leached with sulphuric acid, the liquor decanted, and the copper precipitated with sulphuretted hydrogen. The sulphuric acid is to be regenerated. The sulphuretted hydrogen is to be derived from an auriferous pyrite ore from Georgetown. An 80-ton plant is to be built at once to test the process on a large scale. The single unit of the mill that has already been converted to leaching is showing a tailing of 0.42% copper, and if the Laust process does as well as is anticipated, the Great Falls flow-sheet, which was to have been adopted at Anaconda, will not be introduced.

The other mine at which leaching is to be adopted is that of the Chile Copper Co., the new concern dominated by the Guggenheims and managed by Frederick Hellmann. How important production from this source may become is indicated by the fact that the company has 160,000,000 tons of ore, containing 2.40%. The ore lies largely in the weathering zone, and is, therefore, not amenable to flotation.

The flotation process is rapidly demonstrating its usefulness. At Butte the evidence in the Minerals Separation versus Butte & Superior case has been completed, but no decision is likely to be rendered by the court for some weeks. Whatever may be the outcome as to the validity of the Hyde patents, work at the Butte & Superior has evidently convinced Montana operators that flotation is widely applicable to copper ores. The Inspiration Copper Co., in which J. D. Ryan is now a large factor, has contracted with Minerals Separation Ltd. for a plant without awaiting the outcome of the Butte litigation. Tests made on Inspiration ore by E. H. Nutter show a recovery of 93 to 94% on samples representing 98% of the ore. This was in a 50-ton plant that has been in operation some months. A 600-ton plant is to be built at once and, if it operates as successfully as is anticipated, the 7500-ton wet-concentration plant about to be built will be abandoned and direct flotation adopted instead. The results of this work are being awaited with much interest by copper producers throughout the country. The Cuba Copper Co., of which B.

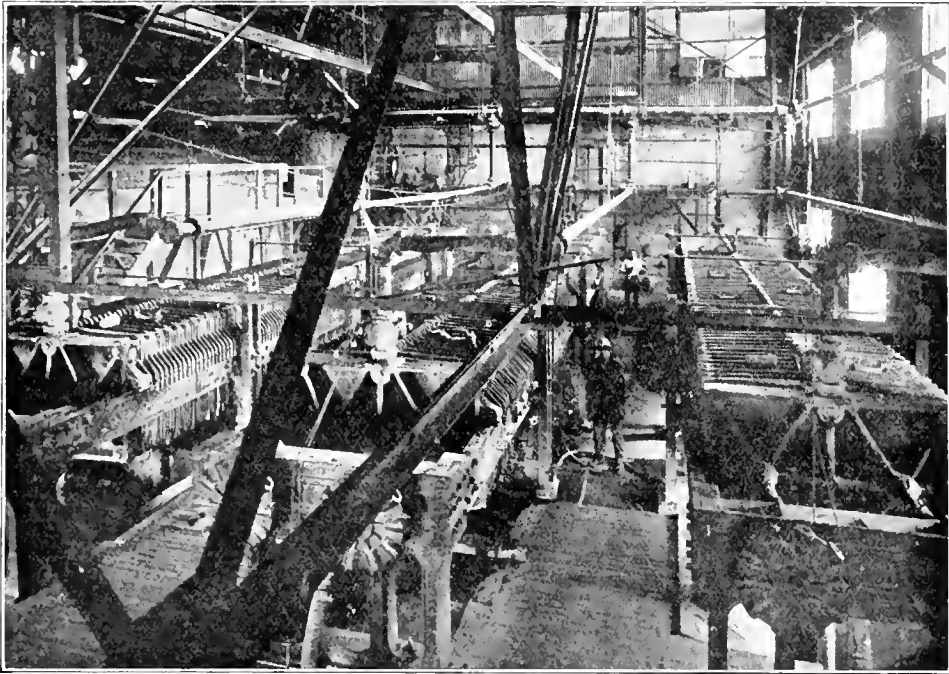
B. Lawrence is president, and which operates near Santiago one of the oldest American copper mines and produces about 5,000,000 lb. of copper per year, is, after initial difficulties, obtaining good results. At the Braden mine, in Chile, trouble has been experienced in treating part of the ore. As an instance of what little things upset well laid plans, it is worth relating that some of the trouble was traced to the cement used to fix the lining in the tube mills. This cement contained free lime which, reacting with the acid, interfered with flotation. At the Britannia mine in British Columbia excellent results are being obtained, the tailing assaying 0.20% copper from an ore that contains 6%. The plant is being enlarged. At La Touche island, Alaska, flotation is to be tried on the ore of Beatson's Bonanza mine and, as it is a silicious ore containing chalcopyrite and unaltered sulphides, the treatment should be successful. It will be less easy to adapt the process to the Bonanza ore at Kennicott, though that is under contemplation. The Kennicott ore is in limestone, the chief copper mineral being chalcocite. It will be remembered that it is from this mine that cargoes of ore containing 72% copper have been shipped. The low-grade ore now being treated by wet-concentration contains about 14% copper. The Kennicott Mines Co., by the way, has just paid a fourth dividend of \$1,000,000, so that this, among the properties of the Alaska Syndicate, shows a good record of profit. If flotation proves successful at La Touche, the prospects of the copper mines in the Greenstone belt extending from Chitna to Kennicott will be greatly improved. Large masses of rock occur there containing copper sulphides, but despite the persistent efforts of James Phillips, jr., and others, the balance of opinion so far has been against their economic value.

California Oilfields.—Statistics of production in the California oilfields for the first quarter of the year show that the industry is in excellent condition. The total output for the three months amounted to 23,069,906 bbl., an increase of 1,259,718 bbl. over the production for the corresponding quarter of 1912. For the same period consumption also increased by 2,852,649 bbl., amounting to 22,771,771 bbl. While this shows that consumption is gaining on production, the total reserves below and above ground are so large that this movement can only affect prices slowly. Dividends continue to be paid with satisfactory regularity. The total for April amounted to \$1,352,122, the Associated ranking first with

a distribution of \$600,000. The Union Oil Co. paid \$184,753, and the Producers' Transportation \$105,000. Among recent company reports of interest to English readers is that of the California Oilfields, Ltd., which shows a gross income for 1912 of £185,536. The company paid £11,000 interest on its debentures, placed £20,000 in the reserve fund, disbursed dividends to the amount of £113,000, being 30%, and had a surplus of £2465.

That production in the Midway field is still

and with a slight increase being apparent each month. It indicates that a great production still awaits operations. For some time there has been no inducement for operators to develop the low-grade oilfields, and only those who have the assurance of getting better than 18° oil have been bringing-in new wells by choice. The output could probably be brought up to more than double the present amount if there was a satisfactory rise in price for low-grade oil.



MERRILL PRECIPITATION-PRESSES AT PITTSBURG-SILVER PEAK CYANIDE PLANT.

increasing, despite the fact that phenomenal gushers are no longer a feature, is shown by the following figures of wells and output :

Month	Number of wells	Production Barrels
June.....	644	2,032,838
July.....	665	2,129,646
August.....	682	2,182,187
September.....	705	2,249,451
October.....	723	2,639,286
November.....	695	2,393,008
December.....	681	2,335,798
January.....	685	2,290,282
February.....	697	2,294,613
March.....	749	2,392,150

This shows a production of more than 2,000,000 bbl. per month, without a break,

Advanced legislation regarding social problems is coming in deluges. Throughout the United States from Washington to California a large amount of legislation along new lines has been framed this winter. The Legislature that adjourned at Sacramento in May was no exception, and seemed fully imbued with the spirit of the times. Among acts passed that specially touch the mining industry the Workmen's Compensation law stands first. In effect, though not in terms, it requires every employer to take out accident insurance for the benefit of each employee, but, to preclude excessive charges, an insurance company is to be financed by the State and is to furnish insurance covering every risk, at cost. Incidentally, and it is one of

the features of the bill, a department is to be organized which, by means of inspection and public propaganda, is expected to greatly improve the conditions in industrial establishments. The act was drawn by a commission after a year's study of the subject and is modern in every detail. It is impossible to say what its results will be in practice, but it is safe to predict that it will not be as good as its friends hoped and it may be as bad as its enemies predicted. The proposal to restrict gold dredging was defeated, as was also that to provide for mine inspection. Presumably the new department of safety will cover the latter field satisfactorily. The State Board of Health, the State Veterinarian, and the State Horticulturist are to join in a commission that is given large if not dangerous powers over smelters, and the smelting industry is evidently to be still further harassed. The plant of the Mammoth Copper Co. at Kennett was recently adjudged a nuisance by a local court, but is still running. The dramatic feature of the session of the Legislature was the fight over alien ownership of land. The bills first introduced were far-reaching and drastic. The one finally passed is almost ridiculously circumscribed in comparison, and a vast amount of bad feeling has been aroused over a small matter with little result. However, certain gentlemen attained prominent positions under the spot-light, and in the gentle art of politics that is a factor of no small importance. I refer to this matter in detail in the next paragraph.

The Anti-Alien agitation that has caused so much discussion in California is probably not properly understood in England, though plenty of news-items have been dispatched by the daily press. It was at first proposed to exclude from land ownership in California aliens and corporations of which the majority of stock was held by aliens, and even to require sale within a year of lands now so owned. Such a drastic law, in so far at least as it was retrospective, probably would not have been sustained by the courts if passed, but it is worth noting that it would have been fatal to such companies as the Mountain Copper Co. and the California Oilfields. It needed only a little reflection to show that whatever might be the rights of the State, the time had not come for California to attempt to dispense with foreign capital. Eventually the real cause of the agitation was found to be the local prejudice against the Japanese in farming communities. These enterprising people have shown their ability to hold their own; indeed

it is admitted that they more than hold their own, in competition with the natives of the state. No candid consideration of areas and numbers can be made to show that they constitute a menace to the state; but the Japanese decline emphatically to assume that humble attitude that Americans have come to expect in emigrants, and they are a source of irritation. Therefore it was good politics for local leaders to propose legislation that covertly, though not in terms, gave them a slap in the face: it being always remembered that Japanese have no votes in America unless native born. The demand for this, once the opportunity came, was so strong that even the appeals of the President, Mr. Wilson, and the special journey of the Secretary of State, Mr. Bryan, were unavailing, and a law was finally enacted which, in effect, prohibits Japanese from owning agricultural lands and only allows them to lease tracts for three years at a time. The whole matter has now been made the subject of diplomatic negotiations. The governments at Washington and Tokyo have displayed admirable tact and good sense, and when Californians come to look back on the incident they may be just a little ashamed.

TORONTO.

Porcupine.—Mining operators were impeded during the greater part of the month by damage to the power plants at Sandy Falls and Waiwaitan Falls from floods, owing to which the supply of electric power was temporarily cut-off. The damage, however, proved to be not nearly as serious as at first reported, and is being quickly repaired, power now being available for most of the mines. The stoppage, however, caused quite a drop in the stock market, and several of the issues registered new low records. The Dome was not much affected in its operations, having a steam auxiliary plant. A special meeting of the shareholders is called for the 27th inst. to ratify a bye-law increasing the capital stock from \$3,500,000 to \$5,000,000. It is proposed to offer an immediate issue of \$500,000 to shareholders at par, and hold the balance of \$1,000,000 in the treasury to meet the outlay for extensions to the mill. The consulting engineer, W. W. Mein, reports that there is 315,528 tons of ore developed above the 45-ft. level of an average grade of \$7'53, and 250,000 tons between the 45-ft. and 100-ft. levels, which cannot be closely valued at present. The extension of the mill-capacity from 40 to 100 stamps according to present plans will enable the mill to deal with large tonnages of

low-grade ore. The net profits of the Hollinger, according to the latest official statement, from Jan. 1 to April 22, were \$549,894; those of the last four weeks included in the record were \$179,941, showing a substantial increase. In the four weeks ended April 22, the mill ran 86% of the possible running time, and treated 11,357 tons of ore of an average assay-value of \$23'44 per ton. The approximate extraction was 95%. The alterations to the mill are nearly completed. The Jupiter, which suffered from the failure of the power service, has installed its own steam plant, as a provision against future emergencies of the kind. The Pearl Lake is also installing an indepen-

dent steam-power plant, which it is hoped will be in operation by June 1. Another company whose work has for some time been disorganized by the breakdown of the power supply is the Crown Reserve, operating the McEnaney mine. It expects to have a steam plant running in about two months. The first clean-up at the Swastika mill after a run of 26 days took place toward the end of April, and resulted in the production of \$3,500 from 400 tons of ore taken from the 100-ft. and 200-ft. levels. The extraction was about 85%. The Lucky Cross mill at Swastika has begun operations, and is treating about 40 tons per day.

Kirkland Lake.— Much attention has lately been directed to the Kirkland lake dis-

trict, lying a few miles northeast of Swastika, owing to the extraordinary richness of the ore taken from the Foster-Tough claims, the only property so far developed to any notable extent. So far, three shipments of ore from this property have been made, amounting to 73 tons, carrying 21'14 oz. gold per ton, or a total of \$38,737, all of which was taken from an open-cut on one vein to a depth of 24 ft., and an incline shaft to 10'6 ft. The vein has been exposed for 390 ft. on the surface. A five-stamp mill has been installed and is now running. Tests made of the ore have shown that it contains tellurium, which is regarded as a highly favourable indication. Other prop-

erties on which high-grade ore has been found are the Burnside, the Orr, and the Teck-Hughes. The latter company is the first operating in this district to offer stock to the public. It is sinking a shaft to the 100-ft. level on a vein carrying free gold.

Cobalt.—The Rose Van Cutsem syndicate, which principally represents British capital, has secured a controlling interest in the City of Cobalt, having bought approximately 1,250,000 shares of a total of 1,500,000 at 55 cents per share. The old board of directors has been replaced by one representing the new interests, and the head office has been moved from Cobalt to Toronto. The Cobalt holdings of the syndicate now include the Cobalt Townsite 40 acres; Casey Cobalt 120



WINTER SCENE AT PORCUPINE.

acres; Cobalt Lake 49 acres; and City of Cobalt 47 acres, in addition to between 20 and 30 claims adjoining the Casey. The mines now in operation employ about 550 men, and the total daily mill capacity, including extensions now under construction, is 415 tons. The annual report of the Nipissing for 1912 showed a total production of silver of 4,688,261 oz. of the net value of \$2,829,943, which, after deducting all expenses, left a profit of \$2,081,710. The cost of production was 17'39 cents per oz. Dividends of \$1,812,500 were paid, and \$239,210 was added to the surplus, bringing it up to \$1,443,953. The ore reserves were estimated at 9,613,338 oz., as against 7,885,792 oz. at the end of 1911. Hydraulic operations have been begun on the hill to expose new veins. The provincial Mining Commissioner has granted permission to the Kerr Lake and Crown Reserve companies to drain Kerr lake and keep it drained for a period of seven years. The work will be done by immense pumps, which will pump the water into Cross and Giroux lakes. The work will be begun about the middle of July. The draining of the lake will enable the two companies, whose workings are beneath the bed of the lake, to reach ore reserves that cannot now be approached without danger of flooding. The Beaver is about to increase the capacity of the mill from 100 to 125 tons per day. The ball-mill will be enlarged and more tables and internal machinery provided. The Cochrane, recently re-opened, has struck high-grade ore in a winze sunk 45 ft. from the 100-ft. level. The winze will be sunk to 200 ft. and the vein explored by driving. The old King Edward mine, now the York Ontario, recently shipped 20 tons of handpicked ore. A good strike is reported to have been made on the Silver Queen, which is regarded as likely to result in the completion of the option for \$150,000 now held by the Aladdin Mining Co. The Miller Lake-O'Brien, of Gowganda, which has been operated under difficulties owing to the lack of transportation facilities, is using auto trucks to make trips between the mine and Elk lake. Negotiations are on foot for the purchase of this mine by an English syndicate.

New Placer Goldfield.—There has been a rush of prospectors and mining men to Cartier, in the Sudbury district, owing to reports of rich discoveries of placer gold, and a large number of claims have been staked. On one property, known as the Mosseau-Lauzen-Carn-fel claim, a sluice-box for washing the gold is being erected.

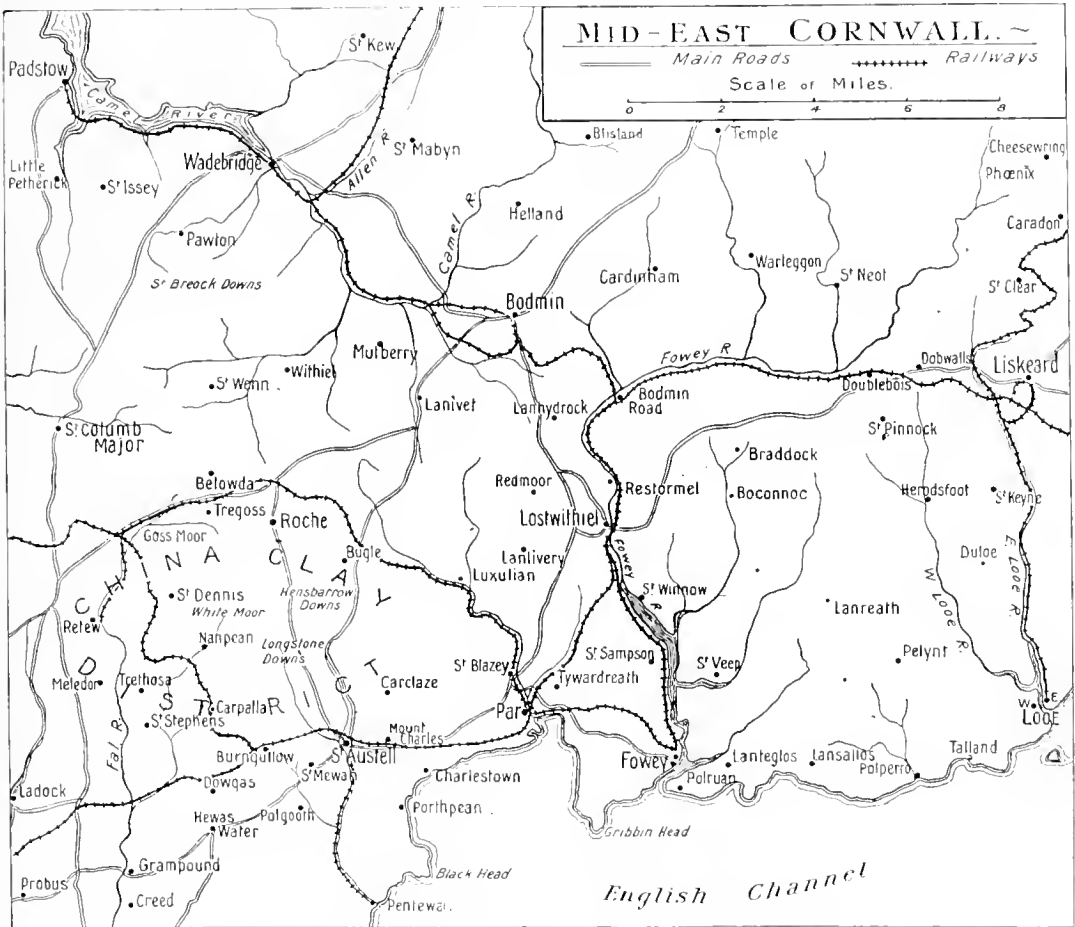
CAMBORNE

Another Alluvial Proposition. Last month the Carnon Valley (Cornwall) Limited was registered with an authorized capital of £175,000 in £1 shares, by the same group as controls the highly successful Cornwall Tailings Company Limited, which, it will be recalled, is treating the Carn Brea & Tincroft sand heaps. The directorate includes J. T. Lempriere and W. S. Robinson. It is proposed to work a large portion of the Carnon valley and the Restronguet creek. Through the former runs the river system that traverses the once important metalliferous district of Gwen-nap, Scorrier, Chacewater, etc., and ends in the Restronguet creek, on the west side of the estuary of the Fal river. It is the intention, I understand, to first work the silt, which in places is of considerable depth, and later the real alluvial ground below. For some years past, a syndicate (of which the late Arthur Claudet was chairman) has been testing the deposit in the Carnon valley near Perranwell station, and a fair-sized dressing-plant has been erected. While the boring and other tests proved the existence of deposits of considerable value, difficulties were encountered in the recovery of the tin owing, among other things, to the presence of a tenacious clay, but no doubt the new proprietors have seen a way to solve the problem. At Restronguet, the tin-bearing gravel occurs beneath about 10 feet of water at low tide, and about 60 feet of mud. An attempt was made many years ago to work this bed but without success. The progress of this new enterprise will be watched with considerable interest.

Phoenix Mines (Liskeard).—At last information is to hand as to how the re-opening of these famous mines is progressing. In September last the property was placed under the control of Bewick, Moreing & Co., who provided £50,000, of which the liabilities of the old company and other non-productive expenses absorbed about £23,000, leaving the balance of £27,000 available as working capital, a sum which it was felt at the time was insufficient to complete the Prince of Wales shaft, the unwatering of the old workings, and to adequately develop the lodes in virgin ground. However, that opinion has yet to be verified; to-day the old workings are unwatered to the bottom level (1272 ft. on the incline), and a commencement has been made to prove the ground below by means of a winze from that level. It is a little early to make an announcement of assay-values, seeing that the winze is only down 5 feet, but it is encourag-

ing for the general managers to be able to report that the lode, for an average width of 5 ft. exposed, assays by vanning 79 lb. of metallic tin per ton. The main shaft is now down 1158 ft. vertical below surface, and it is expected to intersect the lode at 1218 ft., so that in about two months' time the proposed level at this depth should be commenced.

as a claywork, the overburden being china-clay. This apparently overlies a stockwork which is about 30 to 40 ft. thick and can be quarried at a low working cost. Sixty feet to the north, and running parallel to the stockwork, a tin lode has been exposed and two shafts are now being sunk on it. It is proposed to get down 30 fathoms before driving



Cornubia Tin Company, Ltd.—This is a new proposition, the shares of which have been recently introduced on the market at a premium. The company has been promoted by the Cornish Exploration Company, which was formed last year, under excellent auspices, to consolidate the interests of several groups concerned in Cornwall. The property now being developed is situated at Roche in Mid-Cornwall and on the main road to Bugle. Favourable reports have been made by W. E. Thomas and also R. L. Evans (the engineer to the Northern Nigeria Trust). The property appears to have been operated on a small scale

on the lode, and already it is reported that good assay-values have been recorded in sinking. The company has a nominal capital of £75,000 in 10s. shares, of which £35,000 is working capital. The directorate includes James Wickett, while the local management is in the hands of C. H. Cropper.

Diamond-Drilling.—At South Crofty recently an attempt has been made to test by diamond-drilling some ground to the north of the 245-fm. level west of Robinson's shaft, but it is reported that the management is not satisfied with the results achieved. Many years ago a similar experiment was made at Dol-

coath, but experience proved that if the work is undertaken to prove the assay-value of tin lodes, the method is not satisfactory. For locating lodes it is quite another matter, and the surprise is that diamond-drilling has not been more extensively used in Cornwall for this purpose.

St. Ives Consolidated Mines. The improvement in the Grew section of these mines continues. Frank's shaft has been sunk in virgin ground below the 142 fm. level, where the north and south lodes form a junction. The lode in the bottom of the shaft assays 25 lb. black tin per ton over a width of 5 ft; in the 142 fm. level east, it assays 31 lb. per ton over 3½ ft.

The black tin returns from the joint properties for the past six months have been as under :

	Tonnage milled	Sales T. C. Q.			Amount Realized
1912					
Dec 14	... 2032	21	0	0	£2662
1911					
Jan 11	... 1878	14	14	1	£1947
Feb 8	... 1991	18	10	0	£2380
Mar 8	... 1941	19	6	0	£2357
Apr. 5	... 2009	18	0	2	£2263
May 3	... 2192	19	16	2	£2554
	12,033	111	7	1	£14,163

From these figures it will be seen that the average recovery has been slightly over 23 lb. black tin per ton of ore milled, and that the receipts have averaged 23s. 6d. per ton.

Basset Mines, Limited.—For the twelve months ended December 31, 1912, a gross profit of £5405 was earned, from which must be deducted £2000 for depreciation on buildings, and £523 written off investments, so that the net profit was only £2882, which on a turnover of £67,000 is small enough. Comparative tables given below will show that the management of this mine has had a great struggle for the past year or two to make a profit at all, in spite of the excellent price ruling for tin.

	1912	1911	1910
Tons of ore milled.....	46,646	43,286	40,541
Sale of black tin.....	502 tons	580½ tons	699 tons
Amount realized.....	£66,224	£71,220	£65,435
Recovery per ton milled	24 lb.	30 lb.	39 lb.
Total receipts per ton	28s. 4d.	33s. 4d.	32s. 8d.
Total cost per ton	27s. 8d.	30s.	29s. 5d.

The decrease in the working cost is largely due to a slackening of development, the footage for 1912 being 4236, against 6474 in 1911. This decreased development was occasioned by water difficulties and lack of men. The chairman of Basset (Francis Oats) is a strong advocate of energetic development, and at the annual meeting of the company lamen-

ted the reduction in development cost as the "most unfortunate part of the report." The satisfactory feature is that the bottom of the mine shows a considerable improvement in tin content. It was stated that the lode in Pascoe's shaft (the deepest point in the mine) had averaged 40 lb. black tin per ton for the last 25 fathoms of sinking, and this seems substantial evidence that at last the poor zone of ground has been passed. Another important point is the 310-level east of Marriott's shaft on the North lode, which has been driven through a profitable section of ground 70 fathoms in length. The lode here has varied from 2 to 8 feet in width, producing on the average 40 lb. black tin per ton. In the levels above, this lode produced copper, but no tin in payable quantities. It would appear from the report that at last the 'adventurers' are going to secure a reward for their patience and confidence in the mine.

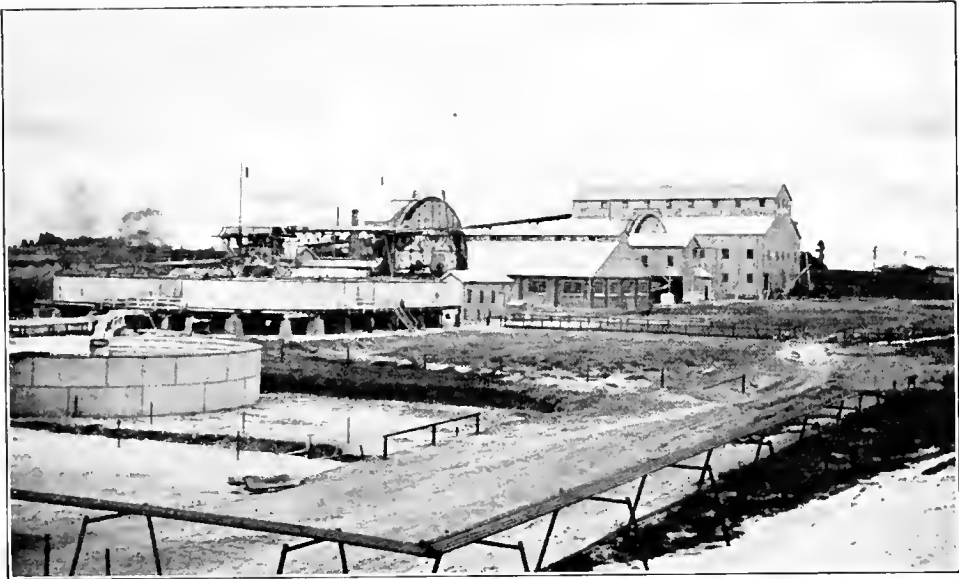
Scarcity of Labour.—Most of the mines are now suffering from lack of miners, and this is one of the most serious of the problems facing the managers of Cornish mines. At Basset, development is perforce curtailed for this reason, and other Camborne mines are similarly affected, but the outlying districts are feeling the pinch most. Foreign countries seem to have a peculiar attraction for young Cornish miners, although if they are prepared to work in Cornwall as hard as abroad, with the present rate of wages, and taking into consideration the low cost of living, it is difficult to see how they are better off abroad.

JOHANNESBURG.

Circular Shafts, after twenty years' neglect, are coming into fashion again. The New Modderfontein resuscitated the idea, and now the Crown Mines and City Deep are rivalling each other in the rush of welcome. The Crown Mines shaft, which will be commenced in two months' time, has for its object the ventilation of the western area, and it will connect at a depth of 2000 ft. with the 13th or main haulage level, which is being extended westwards. The City Deep shaft will be sunk near the northern boundary and in a more or less central position, its object being also ventilation. The sinking of this shaft has been commenced and it is expected that the reef will be intersected in two years time at a depth of 2300 ft. The cost of this work is given as £70,000, but allowing for works in connection and incidental expenditure, the total disbursement will probably be £100,000. Both these shafts will be bricked throughout

and have a diameter of 18 ft. The need of these shafts raises the question: What other mines will have to sink shafts for ventilating purposes? The point is important, because with some properties the effect on the dividend would be serious. There is also the contingency that the Government, which is daily becoming more humanitarian as regards its responsibility to the underground workers, may compel certain mines to sink ventilating shafts whether they wish to or not. Technically these circular shafts, departing as they do from

it is not comforting to be told that the ore reserve for this year is 0.2 dwt. lower in value than the reserve for last year. For the quarter ended March 31, the yield per ton was 17s. 3d. and the cost 14s. 4d., leaving a profit of 2s. 1d., which compares favourably with last year's average, 1s. 2d. This low working cost indicates an excellent organization, but it depends for its continuance on the present rate of crushing of over 60,000 tons per month being maintained, and this in its turn is governed by the native labour supply. In a mine such as



MILL OF THE ROODEPOORT UNITED MAIN REEF.

current practice, are refreshingly interesting, and they furnish a proof that the Rand is able to get out of its groove now and then, and that there are still engineers plucky enough to benefit by experience in other lands.

The Simmer Deep has vainly endeavoured, ever since it started crushing in 1908, to reach the ranks of respectability by paying a dividend. Staggering under the load of £1,650,000 capital, £630,800 first debentures and £262,500 second debentures, and an ore reserve having an assay-value of 4.2 dwt., it would indeed be a wonder if it made good. The net result for the year 1912 was a loss of £4,230, and the working cost was on the low level of 16s. 4d., which must be considered creditable for a working depth of 3500 ft. When it is noted that the yield was only 17s. 6d., it can readily be seen what a narrow margin this company has, and for this reason

this, where the ore is of uniformly low grade, the only possible means of success lie in large-scale operation and low working cost. In this connection the question arises whether it would be possible or economically sound to raise the value of the ore milled by selective mining. The answer to this, as far as this mine is concerned, is that such a course is not possible owing to the fact that the better portion of the reserve amounts to merely 6% of the total, and the value of it to only 4.75 dwt. It is evident from this that the gold distribution in the three reefs worked is of a remarkably uniform character, all being equally poor. If a selective policy were adopted, therefore, the improvement would not be remarkable, and the practice could be continued for a limited period of time. Turning to the March quarter again, the working profit was at the rate of £76,472 per annum, as against £35,546

for 1912, and the rate of crushing 741,000 tons per annum as against 591,650. It is hoped, finances permitting, to increase the plant to a capacity of 900,000 tons per annum. Prospects are thus more hopeful, but for all that the company has a long and difficult road to travel.

White Employees on the mines are, thanks to Mr. R. W. Schumacher, who shares with Sir Lionel Phillips the responsible control of the Central Mining and Rand Mines group, at present having a good deal of attention directed to their condition of employment and mode of life. Mr. Schumacher has been taking part in a public debate on the subject of insecurity of tenure and other matters, and in replying to the discussion he referred to his intention of giving the men employed at his mines an opportunity of acquiring their own homes at a reasonable cost. He had been asked what was the need for his proposed housing schemes while there were fifty thousand stands still unsold in the townships round Johannesburg, and his reply was that the prices demanded were exorbitant, and that he at any rate was determined to give his men land for practically nothing, whatever criticisms might be levelled at him for doing so. The idea of his firm was to end the holding-up of land and its non-sale except at high prices, and to place thousands of acres at the disposal of mine employees on the easiest possible terms. A start had been made by building forty houses on rising ground to the south of the City Deep. His firm would make no profit, and might make a loss, but it was of more importance to keep good men than to save the £70,000 they intended to spend. As regards the continual changes taking place among miners, he was of opinion that it ought to be stopped, one way being to let contracts for longer periods. An analysis of the earnings of a large number of underground contractors for the month of August 1912, showed the following: Earning over £100 for 27 shifts, 41 men; between £90 and £100, 41; between £80 and £90, 48; between £70 and £80, 87; between £60 and £70, 157; between £50 and £60, 267; between £40 and £50, 378; between £30 and £40, 578; between £20 and £30, 696; between £10 and £20, 291; up to £10, 64; and losing on the month's wage, 30. The cutting of the miners' contract-price he agreed was wrong, and that when it was done it clearly showed that the price set in the first instance by the management was the result of bad estimation.

The example set by Mr. Schumacher is one

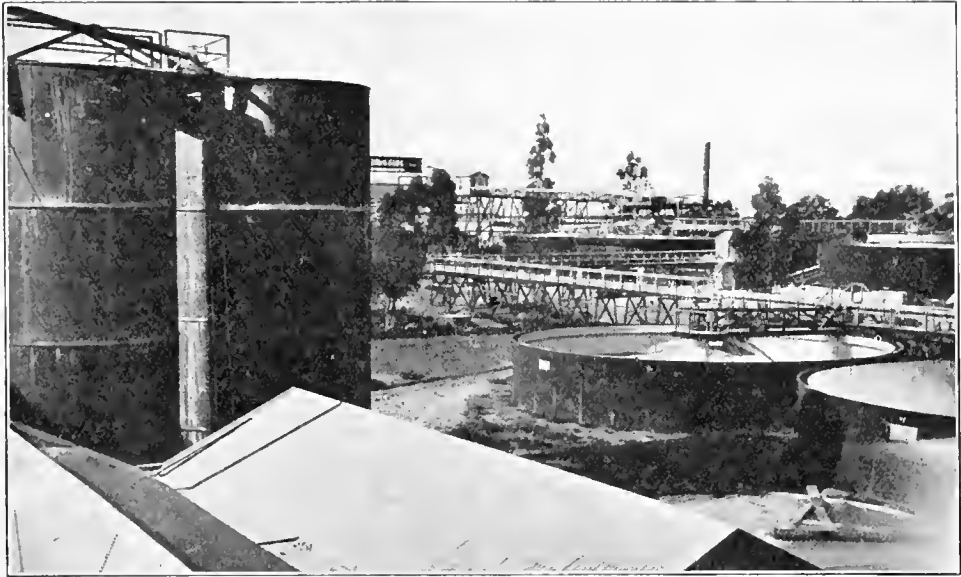
worthy of imitation; it shows that he at least is not afraid to face criticism, and it indicates that the magnates are becoming alive to the necessity of being less hopelessly out of touch with their men than they used to be.

The Tropical Native is no longer to be recruited for the mines. The Government has come to this decision owing to the terrible mortality among them. The sinister part of the whole business lies in the fact that the deaths in the Witwatersrand Native Labour Association's compound were not included in the mortality returns, in consequence of which the death-rate appeared to be much lower than it really was. The Minister of Native Affairs, Mr. Sauer, stated that he had made careful inquiries and that although he did not think there was any improper motive, the fact remained that important information was not supplied and not demanded, with the result that the information as to mortality among tropical natives published to the world was entirely misleading, and he had come to the conclusion that there was a considerable amount of blame to be attached both to the W.L.N.A. and the Native Affairs department. To show the masked position as compared with the true one he quoted the returns for the months of January, February, March, and April, which gave the death-rate per 1000 per annum on the mines and works for those months. This was as follows: January, 44·6; February, 64·1; March, 71·8; and April, 51·5. Including the mortality in the W.L.N.A. compounds the rate was as follows: January, 115·1; February, 117·6; March, 118·5; April, 73·4. From these shocking figures it is easy to understand why the Government has ordered a cessation of recruiting in the districts north of latitude 22 degrees south. The effect of this decision will be that the mines will lose 25,000 natives, though of course not all at once, and the number recruited annually will be less by sixteen thousand men.

The Government Gold Mining Areas, variously known as State Mines, Modder Leases, Government Areas, or Government Leases, is making steady progress in the opening of its large area of 2633 claims. There are four seven-compartment vertical shafts, of which the two northern ones will deal with a length of strike of 10,900 ft., and the two southern ones with a length of 14,200 ft., the distance between shafts from north to south, in the direction of dip, being 7000 ft. During last year the northeast shaft intersected the 'reef' at a depth of 2273 ft., and the northwest shaft at a depth of 2395 ft., the assay results

being, respectively, 7.7 dwt. over 20.5 in., and 7.15 dwt. over 31 in. At March 31 of this year the southeast shaft had reached a depth of 3372 ft., and the southwest shaft a depth of 2966 ft., and assuming a dip of 11° on the line of shafts and no reef dislocations, these shafts should intersect the reef at about 3700 ft. The cost of sinking the shafts during last year varied from £27 to £36 per foot sunk, which cost included sinking, timbering, pumping, and bailing, and the usual internal equipment of a shaft in process of sinking. Although conditions were favourable to good work, these

of the profitable footage, equivalent to 0.3 dwt. over an assumed stopping width of 50 in., is not sufficiently good to effect a counterbalance, though taken by itself it is of course satisfactory enough in conjunction with large scale operations. It must not be forgotten, in connection with these remarks, that the area developed to date is quite insignificant, and that development results, therefore, afford only a faint indication of what may be to come. Financially, the company is in a sound position. At the end of last year the cash on deposit and at bankers amounted to £26,907,



CYANIDE PLANT AT MODDERFONTEIN B.

costs reflect a high state of efficiency, and as a proof of this it may be mentioned that in March of that year a footage of no less than 233 ft. was accomplished in the southeast shaft, which constitutes an easy record for a shaft of this size. Since the intersection of the reef in the northern shafts, development has been actively pushed, and at March 31 the footage exposing reef amounted to 3661 ft. The assay-value of this footage was not high, the average being only 10.8 dwt. over 18.9 in. In the report for the quarter ended March 31, 1913, the commendable practice is adopted of giving the profitable and unprofitable sampling results separately, and we learn that the former amounted to 54% of the total for that period and had an average assay-value of 13.4 dwt. over 23.4 in. This percentage of profitability is rather low, and the assay-value

and there was still 18s. per share to be called on 775,000 shares. The capital of the company is £1,400,000, all available as working capital, there being no vendors' consideration as with other properties. The absence of vendors is due to the fact that the ground is leased by the company from the Government. In exchange for this facility it will, when producing, pay a tax on profits varying from 10% to 50% depending on the ratio of profit to output. If profits are low the tax will correspond to the profits-tax paid under the usual conditions, but if the profits are high the amount of tax will be heavier than that usually paid. As against this must be considered the reasonable capital, which is made possible by leasing the ground, not buying it, and the protection afforded to shareholders by the terms of the lease. It is hoped that in twelve months' time

development will be far enough advanced to justify a commencement being made with the erection of a reduction plant, which means that crushing should start early in 1915. The size of the plant to be installed has not yet been decided, but the intention is to place one of considerable capacity near the southeast shaft.

The Geduld Proprietary Mines has increased its reduction plant by the addition of 10 stamps, 4 tube mills, Caldecott tables, Butters filters and Brown agitators, making the total to 60 stamps and 5 tube mills. The new portion will start at the end of June and the enlarged mill will be capable of crushing 24,000 tons per month. The history of the company has not been such as would point to a brilliant future. Crushing started on November 1, 1908, and shortly afterwards the mine was filled by a sudden inflow of water and remained so for a year. Then the extraction plant was a cheap one, and this, coupled with the flouxy nature of the gold in this particular ore, precluded anything like a satisfactory extraction. The trifling scale of operations also prevented any effect being observable on the large claim area and capital. In 1912 a profit of £56,996 was obtained as against one of £39,969 in 1911; the yield per ton remained stationary at 26s. 9d., the cost decreased from 21s. 9d. to 20s. 10d., and the profit rose from 5s. 0d. to 5s. 10d. The ore reserve was considerably increased, and at the end of the year it amounted to 1,475,000 stopetons made available for mining by 24,990 feet of development, the average linear assay of which was 6.98 dwt. over a stoping width of 52.8 in. The consulting engineer of this company declines to apply the development average direct to the reserve tonnage in the usual way, as he holds that development results do not afford sufficient information on which to base an accurate estimate of the value of the tonnage contained in large blocks. This seems a super-cautious, even timid, view to take, and it is one not shared by the consulting engineers of Modder B, Brakpan, and other large-block mines. Compared with the 'indirect' value of the reserve of 1911, the reserve of 1912 shows just a faint improvement in content. In the March quarter 65% of the footage sampled was profitable and averaged 9.21 dwt. over 35.5 in., or 327 inch-dwt., as against 369 inch-dwt. for the ore-reserve footage of 1912, thus pointing to a tendency for the assay-value of the ore to depreciate rather than to appreciate. The 'profit' amounted to £11,930, which also shows a decrease, but this is due

largely to the disturbing effect of the preparations for the starting of the new plant; this disturbance will also exercise a depressing effect upon the revenue for the June quarter. As regards the results achieved in 1912, it is to be noted that 34% of the tonnage crushed was low-grade development rock and that the yield was in consequence below what the reserve under normal conditions might be expected to furnish. The mining practice presents no striking feature. There are two vertical shafts 3000 ft. apart. No. 2, where all development was concentrated last year, reaches the reef at a depth of 1695 ft. and No. 3 at a depth of 1853 ft. As is usual in this area, the pay-reef lies on a slate footwall, and the average dip is 8°. Pillars are left only along the important ways of communication or to protect permanent works, and packing is used for protecting the stopes. Water has caused much inconvenience in the past and last year 626 million gallons was lifted to the surface against a head of 1850 ft., at a cost of £21,669 or 8.31d. per 1000 gallons: this quantity tends to increase, as in January a fresh feeder was struck which is giving 15 million gallons per month. Machines are more favoured than they were, 38% of the ore in stopes being broken by them last year as against 19% in the previous year. In prophesying about a dividend, it is within memory that the company has never yet increased shareholders' bank balances by a distribution of earnings, but when the full plant is running we may hope that improved profits will accrue. In view, however, of the still modest dimensions of the reduction plant as compared with the size of the capital, £875,000, it seems fairly safe to predict that the property as at present worked will never succeed in struggling above the 10% dividend level and may possibly not reach even that.

Flotation.—The arguments in connection with the lawsuit instituted by Minerals Separation, Limited, and James M. Hyde, for infringement by the latter at the Butte & Superior mine, Montana, have been concluded, and the judge has intimated that some time will elapse before he gives judgment.

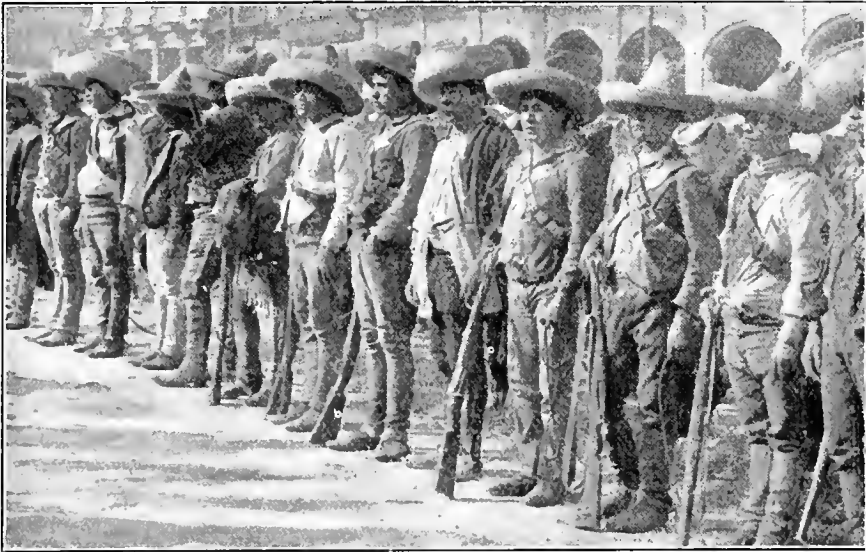
NEW YORK.

The Situation in Mexico remains hopelessly complex, and most divergent opinions are expressed by operators who have recently returned from that distressful country. In the north, Carranza is in control almost everywhere except at Guaymas, and conditions are fairly quiet. At Cananea there was a good

deal of disturbance due, curiously enough, to the fact that the company was unable to keep work going at the regular rate. Insurgent activities along the line of the Southern Pacific had so interrupted traffic that the supply of fuel threatened to become short, and the manager, J. S. Douglas, began to curtail operations. Dismissal of the men caused protest, and numbers of them were employed at cleaning-up and other odd jobs at a reduced wage. This was regarded as an attempt to reduce wages and the protest became so strong that Mr. Douglas was obliged to leave Cananea. Later the situation cleared, and by the end of

balance of \$11,000,000 still due. A loan of \$25,000,000 has already been floated to rehabilitate the National Railways. The National Railways has \$10,000,000 in 4½% notes maturing June 1, and Speyer & Co., Kuhn, Loeb & Co., and Ladenburg, Thalmann & Co. are engaged in the financing necessary.

Copper.—The report of the Amalgamated Copper Co. shows a surplus on hand of \$24,000,000, and its principal subsidiary, the Anaconda Copper Mining Co., paid dividends at the rate of 12% upon its capitalization of \$108,000,000 and added \$6,000,000 to its surplus. Another interesting feature of the re-



A SQUAD OF RURALES, OR MEXICAN GENDARMERIE.

May the plant was practically in full operation again. In some quarters work has been little affected by the revolution, in others it has come to a complete standstill, with no hope for speedy resumption. The \$100,000,000 loan which has been sanctioned by Congress and for which funds appear to be available in Europe, is variously interpreted as likely to provide the Diaz-Huerta government with sufficient money to completely control the situation, and as merely furnishing a further prize round which intriguing politicians can squabble. An advance of \$10,000,000 has already been made by the bankers making this loan, and this sum has been paid over to Speyer & Co. in part liquidation of the debt contracted by the Madero government a year ago. It is reported that Speyer & Co. have agreed to underwrite bonds extending the

port is the purchase of 150,000 shares of Inspiration Consolidated stock during the year. The Inspiration is evidently practically controlled by the Amalgamated, the offices of the two companies being adjacent at 42, Broadway. The action of the Amalgamated, the leading company mining copper by time-honoured methods, in taking a hand in what promises to be one of the leading companies of the low-cost porphyry coppers, has been the cause of much comment. There are marked signs of a *rapprochement* between all the leading copper companies of the southwestern United States, and the 'copper trust,' so much discussed a year or two ago, may be to all intents secured by exchange of shareholdings in the leading copper companies. L. D. Ricketts, who is consulting engineer for the Arizona Copper as well as Cananea Consolidated (con-

trolled by Amalgamated) and the Phelps-Dodge properties, now has his headquarters at 42, Broadway, across the hall from the Amalgamated offices, so that the big companies are at least neighbourly.

The Chino and Ray Consolidated Copper companies have at last entered the ranks of the dividend payers, a quarterly dividend of 75 c. per share having been declared on Chino stock on May 27, and 37½ c. per share being declared on Ray Consolidated on the same day. The annual reports of these companies were received last month. It is interesting to note, however, that so far as French investors are concerned, this is the second dividend on Chino shares instead of the first. When the shares were placed on the Paris market the first buyers cashed a premium of 1.25 francs per share, and the shares were afterwards officially quoted as "coupon No. 1 stamped for instalment dividend paid." The declaration of a quarterly dividend of 75 c. places Chino on the basis of \$3 per share per year. The dividend had little effect upon the selling price of the shares, as it had long been expected.

A. C. Burrage is being sued by Louis Ross of Boston for a division of profits in the flotation of the Chile Copper Co., the \$110,000,000 corporation promoted by the Guggenheim Exploration Co., of which mention was made last month. Ross, who claims to have originally obtained the options upon the properties in question, charges that Mr. Burrage concealed important facts concerning the value of the properties, attempting to secure Ross's interest at a price below its actual value and in accordance with their agreement. The suit is for a 10% interest in the \$25,000,000 of the capital stock of the Chile Copper Co., which A. C. Burrage is alleged to have received for his share in connection with the flotation of the company.

Samuel Untermeyer has been getting a good deal of undesirable publicity recently in the *New York Sun*, which has revived the unsavoury story of the Harney Peak Mining and Milling Co., into which English investors put £400,000 for the purpose of mining tin, but which has yielded instead a small amount of lithia salts, convenient for relieving the resulting headache. The properties, a number of claims on which occurred narrow tin-bearing veins, were under option to the Phelps-Dodge interests over twenty-five years ago, but were abandoned as valueless. Mr. Untermeyer and his associates then got hold of them and proceeded to float the venture in

London. In spite of the active opposition of the *Financial News*, Mr. Untermeyer, who had previously been successful in securing English capital for investment in American breweries, raised £400,000, and the story goes that the geologist sent over to examine the property was kept so liberally supplied with liquid refreshment that he did not detect that the tin ore upon the dump had been secured from other properties, the frugal management purchasing it with company funds and having it carted from dump to dump after dark when a day's sampling was completed. The veins looked promising but did not persist in depth, and the greater amount of the black material present in the ore proved to be tourmaline instead of cassiterite. The company was soon in difficulties and the English shareholders brought suit in 1894, asking for an accounting and that a receiver be appointed. A. R. Ledoux was appointed receiver, the only good luck the shareholders had, as the suit dragged on for fifteen years. It was alleged that Untermeyer received \$13,000 in cash and \$90,000 in stock for his efforts in raising English capital. With a clever and unscrupulous lawyer for chief defendant, the law's delays were used to purpose, and it was only recently that the company was reorganized, as the Palasapa Mining Co. Mr. Untermeyer's associates provided \$50,000 with which to continue exploration work, but as he claimed to be the attorney for the syndicate he was relieved of the necessity of supplying any cash. The reason for recalling the story just now is perhaps the conclusion of the suit by C. R. Flynn against a new York syndicate composed of William H. Brevoort, Willis McNornick, Clarence K. McNornick, Thomas T. M. Raborg, George Martin Luther, Otto Germer, Barnard M. Baruch, Payne Whitney, and Samuel Newhouse, for a 10% interest in the profits derived from the flotation of the King Edward and Watts mines at Cobalt. Flynn, who is an experienced Alaskan prospector, was retained to select claims at Cobalt for a contingent interest in the profits derived from their exploitation, but was 'frozen out' when the deal was made. The judge awarded him \$360,000 and interest, the full amount of the claim. Raking up Mr. Untermeyer's past may also be a sequel of the Pujo investigation of last winter, in which Mr. Untermeyer gave the house of J. P. Morgan & Co. some unpleasant moments by virtue of his knowledge of inner affairs gained while serving the firm, thus perhaps producing a very natural desire to 'get back at him.'

DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

Miners' Phthisis on the Rand.

The Editor:

Sir—I am writing to you in the hope that you will make some effort to stop the wholesale murder that is now and has for many years been going on in the Witwatersrand mines. I enclose marked printed matter that will put you *au fait* with some of the recent facts, but for the benefit of your readers I will give a short summary of the position.

The present Phthisis Compensation Board has had 2413 claims presented to it in six months. The applications in January were 11 per day and, I am informed, in February and March from 8 to 11 per day. Very few of these can be described as 'cumulative' cases, as the applicant has to show 2 years' work out of the previous 4. The miner who has left the country has been barred, practically, by a ruling (only just withdrawn) that the application has to be certified by a Rand doctor. Owing to the shortage of efficient miners, the mine controllers are winking at the continual employment of men in an advanced stage of silicosis, and this collusion is furthered by the fact that before the miner can receive the meagre compensation of £8 a month for 1 year, he must give up his blasting ticket and livelihood. Many men continue working, knowing they are doomed, for the sake of their wives and families.

There have been no arrivals of miners from abroad for many months, and consequently a large and increasing proportion of the underground men are now Africans. It is generally agreed that these men, being the progeny of those living an out-door life, succumb to silicosis much more quickly than the foreigner, the latter quickly enough.

The principal sufferers are the rock-drill men. More than half the bad cases occur among them. They only number altogether about 3000 in employment at one time; and it is clear enough that about half of them are knocked-out every year. This is a state of occupational disease unequalled in the so-called civilized world.

I took up this question in the *Transvaal Leader* in the latter part of 1910, and, partly as a consequence, the present Phthisis Compensation Act was passed. My figures and

conclusions were derided and treated as scare-mongering; it is now proved that they were all understatements. Under a succession of supine and indifferent governments the 'industry' has needlessly killed and scrapped with accident and disease about 100,000 human beings since the war. The total of deaths in the British army from bullets and disease, during the whole of the South African war, was only about one-fourth as many.

I am not a party politician in any sense. I ask you to take up this matter for the sake of humanity in general, and also because it is of the utmost importance to the South African community. I am sure, that if you do so, you will not waver in so good a cause.

I have a large amount of material on the subject which will be at your disposal should you desire it.

E. J. MOYNIHAN.

Johannesburg, April 18.

[We refer to this letter in our Editorial columns.—EDITOR].

The Status of the Metallurgist.

The Editor:

Sir—I have noted, with much interest, your definition of a 'mining engineer,' but I venture to suggest that the origin of the word 'engineer' should be remembered when making such definition, and that you should say that such a person is one capable of designing a scheme of operations rather than one only capable of inspection and management. I also note your remark that people with specialized technical knowledge often lack the further qualities required in a good 'mining engineer.' The technical specialist has no desire to usurp the term, but he does object, and strongly too, that a man who may be thoroughly capable in the matter of the inspection or management of mines should be able, under the cloak of the term 'mining engineer,' to report and advise in connection with technical matters on which, by training and experience, he is comparatively ill-informed.

I have in my time seen many instances of the futility of the engineer advising on metallurgical treatment. In one case, the 'mining engineer' was asked to report on the treatment of the ore. He made a report without any

metallurgical examination of the ore. The consultant's pet ideas of an up-to-date plant were embodied in a scheme that cost about £40,000. The result was an entire failure. The first month's efforts were termed 'experimental.' At the end of the second month the 'mining engineer' retired. The services of a second 'mining engineer' were then requisitioned, and a further £25,000 was spent, with similar results. The actual expenditure incurred by either of these men was not within 50% of the calculated amount.

In another instance I can quote, a mining engineer had a series of investigations made by a technical man. Unfortunately he entirely misinterpreted the results, which were plain enough to a trained man. On the mining engineer's report, a scheme of treatment was adopted for 5 or 6 years, with the result of robbing the mine and, incidentally, the shareholders. The end eventually came to these perverted metallurgical notions and the property was shut-down. Afterward the plant was re-modelled on the lines actually indicated by the original experiments.

It seems about time that there should be a definite recognition of the work of the metallurgist in the control of metallurgical operations, and of the work of the metallurgical engineer in the design of such operations. I am not considering, of course, men of proved standing in both departments of the profession, but I refer more particularly to the rank and file of the members of the Institution. I think that it is hardly right that a man should style himself 'metallurgist' (in conjunction with 'mining engineer') when he is not in practice as such and is unable to adduce satisfactory evidence as to technical training and continuous experience sufficient to justify the assumption of capability. To become a member of the Institution one must show experience and proficiency in mining *or* metallurgy. This places the metallurgist on an equal rank with the mining man. Mr. Bedford McNeill's effort to improve the status of the mining engineer by seeking statutory powers to control his behaviour and actions is commendable; but is the mining engineer to be officially allowed to report and advise on metallurgical matters of which he may know nothing?

On the other hand there are a great number of members who have no wish to leave the specialized metallurgical work in which they are engaged. They put forward no claim to the appellation 'mining engineer'; but the importance of their work and the fact that mining operations are only possible when fol-

lowed by efficient metallurgical operations should ensure some measure of protection to those who, however capable, are, under existing conditions, given no chance to assert themselves. The metallurgist, as such, has no future. His only hope is to secede from the ranks, becoming first a manager and later a mining engineer. This means a serious loss to the profession both in technology and inventive effort.

The proposed subscription list for the better protection of mining engineers is likely to meet with a poor response from the metallurgists, unless some measure of recognition is accorded them in the proposed charter.

A. W. ALLEN.

Rhodesia, April 25.

Kyshtim.

The Editor:

Sir—Having just read the article in the April issue of the magazine on Kyshtim, by Mr. J. P. B. Webster, upon my return from South America, I note that credit is given me for carrying out the first experiments there, in connection with the treatment of fine ore and flue dust in a small gas-fired Siemens-Martin open-hearth regenerative furnace, which was part of the ironworks plant at Kyshtim. As a matter of fact, the credit for this work is due to the Russian staff under the direction of Mr. Koliashnokoff, who carried on extensive experiments and obtained excellent results, before my connection with the company, and during the time that I was engaged in building the pyritic smelting plant at Karabash. As I do not wish credit for work and results that rightfully belong to others, I shall be grateful if you will kindly publish this letter.

WALTER G. PERKINS.

London, May 13.

Benue.

The Editor:

Sir—I have only just seen your editorial on Nigerian Tin in which you refer to my report to the Benue (Nigeria) Company, Limited. You take exception to my statement that the Bawa area would be ideal for dredging "were it not for the layers of stiff clay."

Assuming the prospecting work to have been properly carried out, and the machinery and metal-saving appliances to be mechanically efficient, the two principal remaining factors affecting the success or otherwise of the plant are: (1) Proportion of actual to theoretical output; (2) Percentage of metal recoverable. As regards No. 1, the presence

of clay is not in any way a serious drawback, provided the design includes a type of bucket that will tip readily, and a ladder with plenty of overhang, allowing the ground to be well undermined so that the face falls freely. As to No. 2, a clayey wash is a slight but not a serious drawback, and an experienced dredging engineer after a careful examination is able to form an accurate idea as to the percentage of recovery on which it is safe to base his estimates.

Really serious obstacles to successful bucket-dredging are: buried timber, hard and uneven bedrock, and cemented wash. None of these are present in the Benue company's ground.

I hope you will see your way to insert this letter, as I think it may serve to dissipate a misconception as to the detrimental effect of some amount of clay in bucket-dredging propositions.

J. WONTNER BROWN.

London, May 21.

Scientific Prospecting.

The Editor:

Sir—Owing to the wide range of work now embraced by the duties of the 'mining engineer,' it seems to me that there is need for differentiation between the preliminary investigator of ore deposits, and the organizer and administrator of work on such deposits when they have reached a stage at which their prospects are held to warrant the large outlay of capital. The preliminary investigator of deposits—or 'prospecting engineer'—is, I take it, the person Mr. Stephen J. Lett has in view in his letter 'A Plea for Scientific Prospecting,' as apart from the mine manager whose specialty should be administration. This latter work presupposes a thorough knowledge of all underground conditions and problems. But the special administrative faculty or the ability to apply such practical knowledge to the attainment of the best commercial results is not only the outcome of training, but is, like generalship, partly an inherent quality of mind. Similarly, the prospecting engineer will owe his ability to recognize the possible value of deposits not only to geological training, but also to inherent ability to recognize and note all the small facts and features exhibited by a given deposit under consideration, and perceive their real economic bearing.

The present system in the selection of an engineer to examine and report on mineral deposits too often results in the appointment falling to a man who has given proof of his ability as an administrator, his work as such

probably appealing to his directors as business men. Having specialized in administration, he cannot, however, be as good at the other line as if he had chosen the latter as his special work in consequence of a natural bent. And in many cases he will have little, if any, talent, and possibly the minimum of special training for the work. The training of the administrator deals with the practical commercial aspect of mining, and that of the prospecting engineer with the geological and theoretical questions; although, of course, the latter must always bear in mind that his work is to be for the ultimate benefit of the administrator.

Another result that often follows the selection of an administrative man for prospecting and examination is that, realizing his deficiencies in the new work, he also probably lacks interest in it. In consequence, he tends to pursue a policy of safety, in order not to endanger his previously-gained reputation, and requires such an amount of development as a basis for any recommendation, that the deposit is brought beyond the prospect stage, and is approaching his own proper sphere. Should this amount of data not be forthcoming, his tendency is against the recommendation for further development of promising but undeveloped deposits, which, considered by the prospecting engineer, might have been sufficiently encouraging to warrant some exploration. The work of the prospecting engineer deals with the speculative aspect of ore deposits, that is, using the word 'speculative' in the sense of possibilities which, though not certain, may legitimately and reasonably be considered as fair mining risks. The work of the administrative engineer must in itself tend to eradicate the faculty for forecasting uncertainties, and for giving a true proportion to the possibilities, or lack of them, in any given deposit, just because the work deals with the mechanical facts of turning 'ore-in-sight' into the best marketable form at the least cost.

It is, however, obvious that the engineer sent to inspect undeveloped or partly developed properties should not make a practice of indirectly condemning, by a judicious system of hedging, all such properties. For in course of time the company's capital might become depleted by these investigation costs, without any actual mining having taken place; or, on the other hand, the policy of the company might tend to become that of acquiring only fully-developed mines, and often having to do this at considerable outlay. However desirable this latter policy may be, it remains for

someone to conduct the preliminary work; and owing to a considerable amount of judgment being required to decide what justifies expenditure, and how that expenditure is best to be practically applied, much money is often wasted. Properties are taken up that seem, to the genuine prospecting engineer, to hold no bright possibilities of abnormal richness, or immense tonnage, but merely promises of a moderate return on the capital involved, which anything unforeseen might turn into a dead loss.

So far I have dealt with the prospecting engineer in the undeveloped or partly developed stages of deposits. His further work is the examination of full working mines, or abandoned mines, with the view of ascertaining what prospects there are of the opening-up of extensions or parallel bodies, or the recovery of lodes, or of increased assay-values in a lode. It is obvious that this class of work is only a continuation of the work usually known as 'prospepecting.' The same training and the same natural aptitudes and tastes are required. Like the former, it is at present often given to the successful mine manager on the strength of his administrative capacity, which, invaluable as it is in its own sphere, is no guarantee of success in the other.

F. E. B. FRIPP.

Oxford, May 19.

Results from Sampling.

The Editor:

Sir—In looking through the May issue of the Magazine, I was struck by an article entitled 'Results from Sampling,' giving an analysis of the various samplings of a mine in Nicaragua, written by Mr. C. S. Herzig. While I have no doubt that Mr. Herzig is entitled to every credit for his professional work, I trust that he will excuse me for making a few observations upon his article from a general standpoint. I assure him that I have no personal interest in the matter. That is to say, I am not one of the four engineers, designated A, B, C, and D, nor do I know any of them personally.

I regret that Mr. Herzig has unnecessarily gone out of his way to draw a comparison between his own work and that of the other engineers to whom he refers. In common fairness to them, I should like to hear what A, B, C, and D, have to say upon the subject, having regard to the time when each report was made and other circumstances, before feeling quite convinced, as Mr. Herzig's article appears to suggest, that his conclusions were so

much more conservative and better justified than those of one or two of the men, at any rate, who reported previously; although, of course, I do not dispute that some of Mr. Herzig's criticisms from a broad standpoint seem to be warranted by the facts as stated by him.

It must be put to the credit of all the engineers, as Mr. Herzig himself admits, that there is a maximum difference of only about 10% in the average assay-value obtained by their sampling of the mine, although the method of arriving at their results differed considerably.

As regards the engineers denoted by A, B, C, and D, I think it should be said in their favour that they attempted to give the relative extractions of gold and silver in their reports; this is a matter that Mr. Herzig does not cover in his own estimate, and he overlooks it as a point to their credit. Instead he reckons apparently upon an all-round extraction of 88% of the gold and silver combined.

As regards engineer B, the only fault that Mr. Herzig sees in his work is that his estimate of working-cost was too low. But surely some allowance in this respect should be made for the lapse of years between the date when his, B's, examination was made, and subsequent estimates, for an engineer reporting upon a mine, after it has been extensively developed, is in a far better position to judge of what the actual working costs are likely to be, than a man employed at an earlier stage of its history. And it would seem upon Mr. Herzig's own line of argument that engineer D actually deserves commendation for his conservatism on this particular score, since his estimate of working cost is \$4.25 per ton, or 25 cents higher than Mr. Herzig's own figure. Moreover the statement referred to, in the body of D's report, that 8000 tons should be omitted from two blocks seems to discount the alleged over-estimate in his figures, as tabulated, to which Mr. Herzig alludes.

But passing over these minor criticisms, and some other matters that may be open to question, the point that chiefly astonishes me is that there are some figures in the column of 'total value' in the table on page 365 of the Magazine, that I cannot make agree with the tonnages and assays given by Mr. Herzig; and under these circumstances the foundations upon which he builds his arguments appear to me to be materially affected. These figures consequently need material revision, and call for some explanation which the writer of the article will no doubt supply.

It is unfortunate for the support of his argument that Mr. Herzig's own figure of \$498,865 appears on the face of it to be \$99,711 less than it should be, which of course substantially affects the comparison with the other estimates given in the table; and I think that the method of presenting comparative figures of this description, in tabular form, even assuming them to be perfectly correct, is in any case open to grave objection, since there is nothing to show to what extent each individual engineer explained or perhaps qualified such figures in the body of his report.

It is true that Mr. Herzig points out in the foot-note that the tabulated figures under the heading of 'tons of ore,' were not represented as being all 'assured ore,' that is, 'ore in sight.' (For example the 'San Basilio' and the ore included 'between 2 mines' in the estimates given by A and C). But if so, how can we compare the total gross value and net profits calculated on the gross tonnage presented in the different tabulated estimates with Mr. Herzig's estimate of 63,008 tons of 'assured ore,' and the profit it should yield, including only ore on the dump? Mr. Herzig does not give his own figure of net profit, but it may be roughly calculated from the figures given, for the purpose of comparison, assuming that the figures of 'working cost per ton' are to be taken as an average for both the mine and dump-ore, as would seem to be the case in each instance. And I observe that in this estimate of 'assured ore,' whether rightly or not, Mr. Herzig includes 50 feet below the bottom level that does not seem to have been 'blocked out,' which is more, at any rate, than B allows. As there is no explanation given of the grounds upon which these allowances were made, we can only accept Mr. Herzig's statement as it stands.

Further, I should point out that Mr. Herzig allows nothing for ore 'between 2 mines.' May not this be going to the opposite extreme of crediting the ground in question with a possible 357,300 tons? I would like to ask, is the one assumption in fact any more justified than the other?

In conclusion, may I venture to say that I believe it is, generally speaking, desirable even for hard-headed people like mining engineers to refrain from slinging stones. We all have to live together, on occasions, in tin shanties, and in the tropics, at any rate, we may be thankful not to find ourselves in the proverbial glass house.

A. G. CHARLETON.

London, June 4.

Professors and Practitioners.

The Editor:

Sir—Your article under the above heading I have read with great interest, especially because I have had experience in the lecture-room and in the field, and because I am privileged to know eminent men, principally British and American, of both classes. After carefully weighing what you have said and while agreeing with the general tenor of your argument and with its conclusion, I am forced to realize that, by leaving, in connection with your several statements, so much to be tacitly understood, you have perhaps exposed many of them to separate attack; and that, by touching all too lightly upon some of the most important factors, you have not sufficiently forced home the point which you wished to urge.

I submit that, if a man is to be a professor, he must have a broad knowledge of the facts and principles of his subject; that, as the capacity of everyone is limited so that what one person can do, see done, assist in the doing of, or direct the doing of, is to what is or has been done by others just as a drop of water is to the ocean, the path by which this broad knowledge has been acquired must in the main have been through the medium of language, spoken, written, or printed; and that therefore the man must be a scholar whose literary qualifications are of no mean order.

"The ability to convey a fund of ascertained knowledge from one man to many students" involves some of the most important factors in the whole question. To have this ability, a man must possess, as you indicate, a sympathetic, discriminating, and logical mind, which clearly perceives what in quantity and quality can best be received, which then chooses such from its store and arranges the chosen in such wise as to appeal most effectively to the intelligence of another. It is necessary for him to have, in addition to a good knowledge of English, a good delivery of it; for spoken language is the channel along which thoughts are to move from his mind to the student's. There may be some people, priding themselves on being practical, who say a defect in this regard does not matter a great deal if the man knows his subject.

Would they not be the first to find fault with a defective wagon, railroad track, boat, pipe-line, or cable used in conveying something of worth from one place to another? That which is to be conveyed might be damaged or even lost partly or wholly; and the very end in view, the placing of the maximum amount of that which is valuable in a pre-

destined place, be defeated.

Who is more likely to possess the above indicated qualifications? The successful teacher or the successful practitioner?

A professor of a subject, not mining or metallurgy, is usually a man who has had a distinguished or at least very creditable academic career followed by a period of successful teaching; and there can be no reason for supposing that what is essential or desirable in his case is not equally so in that of a professor of mining or metallurgy.

We cannot forget that in the instance of each of these subjects there has been in England a man who, whilst being a famous professor and a celebrated author, was not a practitioner properly so called: Le Neve Foster and Percy.

You say that "the fact that a man is an authority on the cyaniding of gold ores, for example, does not necessarily involve aptitude to teach the general principles of metallurgy." I would add that he may not even be able to give a really good lecture on cyaniding. In any case, if he were attempting to perform the duties of a professor, he would be very prone to devote an undue amount of time to that branch of the subject. In this connection, it may be remarked that there are some mining and metallurgy specialists who admit very candidly that they are most ignorant of branches other than those to which they give their prime attention. All honour to the specialist practitioner who has succeeded in gaining his laurels by devoting almost exclusively his best capacities to one branch of a very important art. But the fact that he is a specialist cannot be regarded as a qualification for professorship.

The case of a man who has had general experience as a practitioner is different from that of the specialist; and the fact that he has had such must be regarded as a strong qualification, to be weighed along with those previously indicated.

That he has been compelled to submit some part of his knowledge to the tempering process of practice must have benefited him. Any liking which we may have for him because he "has done things" ought not, however, to prevent us from remembering that a man who has been only a successful lecturer has also done things, which if more subtle may yet be greater.

Your remarks regarding the age of a newly appointed professor are certain to appeal to most of those of your readers who are interested in the subject, in respect of this part of which it is perhaps pertinent to remember that

Sir Henry Roscoe commenced his professorship at the age of about 23. To appoint a man who is of advanced years and who is quite unacquainted with the elements of teaching would be gruesomely ridiculous; whereas a man who, being of advanced years, is at the same time a skilled lecturer and a successful practitioner, would probably prove to be an excellent professor, who might be of great use for a considerable period if the limit of 60 or 65 years were removed. It seems impossible to explain satisfactorily why this limit exists in the case of a professor but not in that of a judge or statesman. However, while it does exist, the age of a professor at the time of appointment ought to be such that he may occupy the chair for at least 10 years.

What you have said concerning professional practice is certain not to be agreed to by many; for you have struck right at the heart of accepted and established custom, the life of which has probably depended upon an incorrect conception of the duties of a professor and the obsequies of which would be attended with solemn gladness by all who desire thoroughness.

F. W. ARMSTRONG.

London, June 6.

Hoisting is done electrically at the group of mines belonging to the Cananea Consolidated Copper Co. in northern Sonora, Mexico. Power is generated at a central station adjoining the smelter. The waste heat of the furnaces is utilized for steam-raising, and there are additional boilers in which crude oil is used. The engines are of the turbine type, direct-connected to three-phase alternators. Current is sent to ten separate mines, situated from 1 to 7 miles from the power-house. Over 50 hoists, above and below ground, are in use, varying in rating from 55 to 375 horsepower. Of the latter, three have been erected, having 8500 lb. rope-pull, and 1250 ft. per minute rope-speed. The 375 h.p. hoist at the Cananea-Duluth mine is of interest, as it is the first induction-motor hoist in America controlled by a positive electric brake. The braking is not affected by any failure of the line-current, for should the line-current fail during lowering, the flywheel would maintain the excitation of the brake-current for $1\frac{1}{2}$ minutes. This system of positive electric braking has given satisfaction, and others of the same type are being erected in mines in America, where the conditions do not warrant the installation of the more expensive Ward-Leonard system of control.

PERSONAL

J. B. ATKINSON has retired from the Inspectorship of Mines for the Newcastle district of the North of England.

WILLIAM BACH has returned from the Marinsk district, Siberia.

SIDNEY H. BALL is here from New York.

W. J. BARNETT has gone to South America.

HANS C. BEHK has opened an office in the Woolworth Building, New York.

S. W. BELL left for Nigeria on May 28.

H. C. BELLINGER returned to Great Car on May 27.

GEORGE D. BLOOD has returned to Salt Lake City after spending six months in Europe.

C. A. BOLTON has been appointed secretary to the West Australian Chamber of Mines.

F. L. BOSQUI is expected from South Africa.

WALTER BROADBRIDGE has returned from Chile and Peru.

C. B. BRODIGAN, late of the Brakpan, has been appointed manager of the Roodepoort United.

E. H. BULMAN has been appointed manager of the New Kleinfontein mine.

GEORGE BURCHELL, formerly in Nova Scotia, is investigating briquetting methods in Germany.

GELASIO CAETANI sailed for the United States on May 25.

ROBERT CRANSTON returned from Brazil at the end of April and sailed for Colombia early in May.

LUDWIG H. DIEHL is returning from his visit to Australia and New Zealand by way of America.

GODFREY D. DOVETON is at Pachuca.

DAVID DRAPER has gone to Brazil.

A. E. DRUCKER has resigned as consulting metallurgist to the Oriental Consolidated in Korea, and is now technical manager to the Concession Miniere Française, in the same country.

G. W. EDWARDS left for Mexico on June 2.

W. H. GOODCHILD sailed on the *Walmer Castle* for Johannesburg on June 7 and expects to be away three months.

E. M. HAMILTON has returned to England from Cobalt, Ontario.

JAMES A. HEBBARD has resigned as manager of the Langlaagte Estate and is coming to London.

RUSH M. HESS has returned to the United States from Ecuador.

CHARLES S. HERZIG has become chairman of the Mid-Continent (Oklahoma) Oil Company.

A. CAIRNS HODGE left on May 14 for California and British Columbia.

H. H. JOHNSON has left for British Columbia.

HOWARD JOHNSON has been appointed consulting engineer for the Forum River Tin Mines, Nigeria.

HERMANN A. KELLER on his return from Germany sailed for New York.

FRANK LANGLUTH is superintendent of the Dome mill at Porcupine.

F. H. LATHBURY has gone to Montana on behalf of the New Mine Sapphire Company.

BEN B. LAWRENCE is in Cuba.

E. T. MCCARTHY is at Moscow.

FRANK MERRICKS has returned to London from the La Carolina district, southern Spain.

GEORGE V. MICHELL is due in London from Nigeria at the end of June.

HORACE G. NICHOLS has become a partner in the firm of Bambridge, Seymour & Co.

LAURENCE PITBLADO has returned from Chile.

C. W. PURINGTON left on May 31 for the Olekma district of Siberia.

S. F. SHAW, superintendent of the Tiro General mine, Charcas, San Luis Potosi, is in New York.

JESSE SIMMONS is here from Deadwood, South Dakota.

EDWARD A. SMITH has returned from Mexico and is now in Egypt.

VERE H. SMITH has been nominated as president, and EDGAR RICKARD vice-president, of the Mining and Metallurgical Club.

RALPH STOKES is in British Columbia.

E. HOGAN TAYLOR, who has been in charge of the Redjang Lebong mine in Sumatra since 1910, has resigned, and is going to Australia and afterwards to England.

W. H. TREWARTHA-JAMES has returned from Nigeria.

R. N. C. TWITE has gone to Nigeria.

THOMAS WATTERS has returned to England from Bolivia on the conclusion of his contract with the Corocoro Company.

D'ARCY WEATHERBE has retired from the firm of Bainbridge, Seymour & Co., and will continue his consulting practice at 62 London Wall.

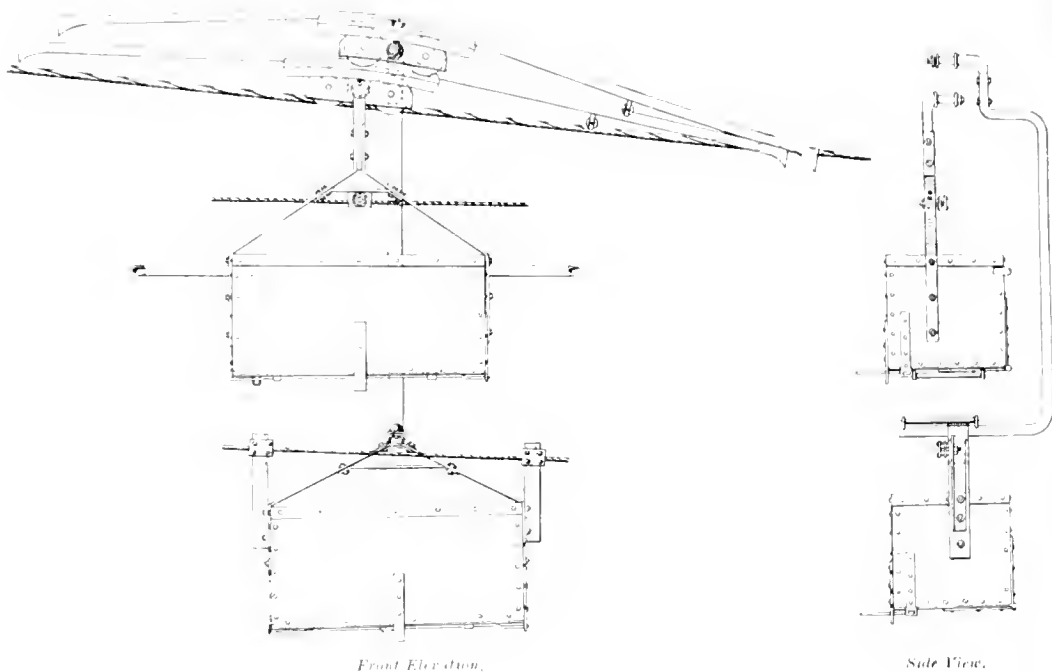
H. H. WEBB left South Africa for England on May 28.

AERIAL ROPEWAY WITH SINGLE CARRYING-ROPE

An Aerial Ropeway erected in Sardinia, of a type suitable for Small Mines owing to low initial cost.

WE illustrate herewith the aerial ropeway built by Mr. E. Praetorius at the Rosas mine, Sardinia. The amount of ore to be brought from the mine to the mill did not warrant the expenditure of as much money as is required in building a ropeway of any usual standard type. The span is 1120 ft., and the fall 220 ft. Mr. Praetorius introduced a novel system, using a single carrying-

the photograph the empty car is the one with the long suspending arm, and it is seen mounting the guide of the descending loaded car. On the next journey, the car with the long arm would keep to the carrying rope, and that with the short arm would ride over it. The constructional work at the two terminals consists of masonry foundations, in which timbers and steel rails are built to serve as sup-

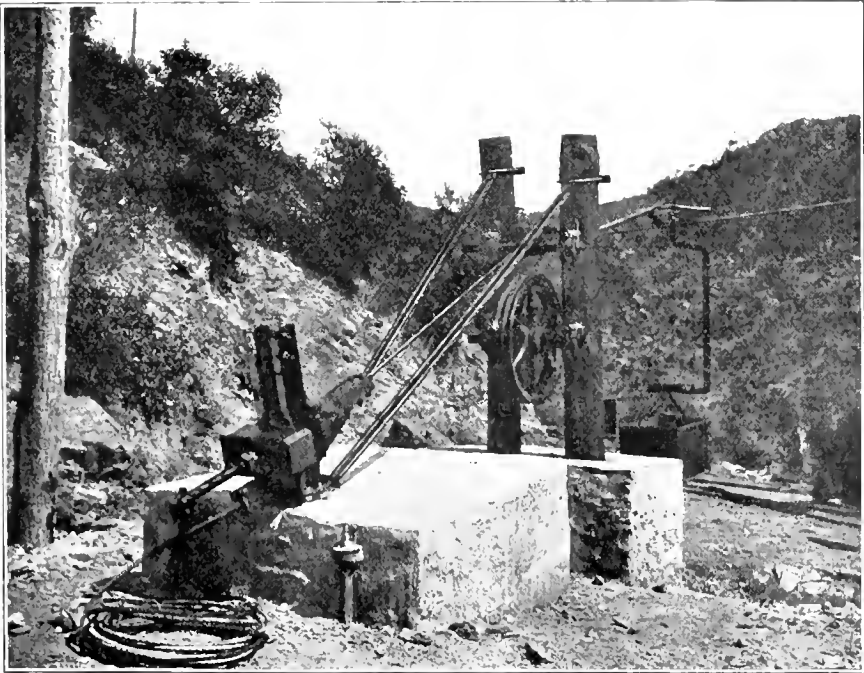


rope, with two buckets. These are suspended from carriers, the arm of one being longer than the other, and clearing each other as shown in the end elevation. Each carrier has a jointed guide fixed above it, and resting at its lower end on the carrying-rope. These guides are held in this position by one side being heavier than the other or by means of springs. By this arrangement, the loaded car travels down the rope, and when the ascending empty car meets it, the carrier of the empty car mounts the guide of the carrier of the descending car and rides right over it. In

ports for the carrying and hauling ropes. The hauling rope passes round pulleys between the number uprights. The pulley at the charging station is fitted with a rim-brake, which regulates the speed of descent. No power is required for moving the buckets, as the inclination of the carrying-rope is sufficient to cause the loaded bucket to descend by its own weight and to return the empty bucket to the loading station. The capacity of each bucket is $5\frac{1}{2}$ cwt. A glance at the photograph of the lower terminal will show how cheaply the ropeway can be installed.



BUCKETS PASSING EACH OTHER



DISCHARGING END OF ROPEWAY.

METAL MARKETS

COPPER.

Average prices of cash standard copper :

May 1913	April 1913	May 1912
£68. 18s. 9d.	£68. 4s. 10d.	£72. 10s. 5d.

The tendency of prices has on the whole been downward. Public confidence shows no revival, in spite of the more cheerful political outlook and the activity of trade, operators being restrained by the dearth of money and the reports assiduously circulated in some circles that trade is beginning to decline. However this may be, there is certainly no diminution in the tonnage of copper entering into consumption, and especially in the electrical industry there appears to be sufficient work in hand, even without new orders, to keep all hands busy for the rest of the year. The brass trade is still fully occupied, and although new orders for shipbuilding are not so plentiful, there is a large accumulation of arrears of old work that will keep the yards in full swing for a great many months. With all this activity it is impossible to take a despondent view of trade, or, since the present level of prices affords only a reasonable profit to the producer, to feel bearish of the market. Technically the position is strong, for there has been much bear speculation during May, to which the downward trend of prices can be traced. The statistical position is favourable, with barely two months' consumption in stock, and the supply of standard warrants is small.

TIN.

Average prices of cash standard tin :

May 1913	April 1913	May 1912
£224. 14s. 3d.	£224. 14s. 2d.	£209. 6s. 1d.

Fluctuations have once more become violent and bewildering, and the course of prices has been a see-saw between the opposing parties. Cash tin has ranged between £232 and £215, but there has been at no time any prolonged tendency in either direction, and the movements of prices appear to the onlooker fitful and meaningless. At the Banca auction on the 28th, the high price of £225. 15s. was realized. It is assumed that this tin has yet to be absorbed by consumers and that a lower level of prices must be reached in order to attract them. The increase of stocks shown at the end of May encourages this opinion, and in fact caused a determined bear attack at the end of the month. Prices gave way sharply under wide selling of three months' metal, and the universal distrust and unsettlement does not lend hope for a speedy recovery. Prices

anyhow are high although so well below the top. While good orders have been given out from America for templates there are persistent reports, which the disappointing deliveries confirm, of a decline in trade from that quarter. In estimating the future course of the market it is to be borne in mind that America has not bought for some time.

SPELTER.

Average prices of good ordinary brands :

May 1913	April 1913	May 1912
£24. 10s. 4d.	£25. 2s. 4d.	£25. 11s. 2d.

There was no animation in the market until the syndicate made a drastic cut in prices on the 26th. A limited quantity was offered for British consumption at 50s. reduction and was sold before the end of the month. A feeling of distrust has been created by these operations and buyers have become shy. It is felt that a further drop is inevitable unless production is curtailed.

LEAD.

Average prices of soft foreign lead :

May 1913	April 1913	May 1912
£18. 14s. 3d.	£17. 8s. 10d.	£16. 10s. 2d.

Lead has again been very strong and for the month a rise of about £2 has been registered. Prices even now do not appear to be at the top, although £20 has been paid repeatedly for May metal. The disturbances in Mexico have seriously affected supplies, while the demand has been urgent and continuous. The cable industry is specially pressing. On the other hand, sheet-rollers report that the higher price is curtailing demand, and the white lead industry is quiet. Old lead is still coming on the market to compete with the imported metal, so the demand is so far little affected. Unfortunately Australian shipments have been seriously curtailed by the recent strikes.

OTHER METALS AND MINERALS.

Prices quoted on June 10 :

SILVER.—27½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

CADMIUM.—3s. 3d. per lb.

ALUMINIUM.—£85 to £90 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£32 to £35 per ton.

QUICKSILVER.—£7. 10s. per flask.

MANGANESE ORE.—9½d. to 11½d. per unit.

IRON ORE.—Cumberland hematite 26s. per ton at mine. Spanish 20s. delivered.

PIG IRON.—Cleveland 59s. per ton. Hematite 78s. per ton.

WOLFRAM ORE.—34s. 6d. per unit (1%).

GENERAL PRINCIPLES OF MILL-DESIGN

By GELASIO CAETANI.

Preliminary Tests. Preparing Drawings. Moist v. Dry Ore. Separate Buildings. Materials of Construction. Elevating Pulp. Circulating System. Duplicates.

IT is vitally important to plan a mill before drawing the plans. This may seem a paradoxical aphorism, but it is not. The most thorough thinking must be done when nothing yet exists. It is necessary to decide the type of mill best suited for the treatment of the ore, where to build it, how to dispose of the general arrangement of the plant, and even to investigate carefully whether there is any need for a mill at all.

The ethics of an engineer have been much discussed in conversation and in print; it would be well to emphasize that his first duty is to advise a client whether a work should or should not be done. A consulting engineer, if asked to examine a mining property that he knows to be worthless, ought to notify his prospective client that the mine does not warrant the expense of the examination, even if in so doing he may lose a job. So also a metallurgical engineer ought to advise against the erection of a reduction plant if he believes that the development of the mine does not warrant it, or if he believes that the economic efficiency of the metallurgical process has not yet been fully proved. It does not pay to be associated with enterprises that fail. The reputation of an engineer does not depend on his ability to do a good piece of work; it depends also on the success of the enterprise with which he has been connected.

Once this point has been cleared, it is necessary to investigate the metallurgical process, and to do that thoroughly. In years gone by it was usual to build a mill along standard lines without taking the trouble to test the ore; once the mill was constructed, the metallurgical process was adjusted and improved during the course of operation. This is done no more. It costs too much to experiment with a large plant. There are now, in almost all large cities, laboratories where an ore can be tested in every conceivable way and on a comparatively large scale. Such testing plants give reliable results: results that are generally duplicated or even improved in actual operation. The only serious danger there is in relying entirely on a limited number of laboratory tests is the possibility that the sample

tested may not be truly representative of the ore in the mine. Small samples furnished by the owners are almost always unreliable. Few men know how to sample; a true average sample is difficult to take and involves much labour; it is much easier to shoot down a few tons from the roof of a drift and to call this sample "typically representative of the mine." A metallurgical engineer, therefore, ought to make it a special point to superintend the breaking of the sample that will be used for testing.

Even with all this the results cannot be considered absolutely reliable in many cases. Nowadays all large mining enterprises adopt the safer system of erecting an experimental mill at the mine, where the ore can be tested on a large scale. Separate runs are made on ores from various parts of the mine; this affords, also, an excellent method of sampling the mine. The large copper companies have erected experimental plants having as much as 150 tons capacity per 24 hours.

How to test an ore is a subject that will not be discussed here; it is too wide and important to be dismissed in a few words. Let it suffice to say that the usual method or the one that will first come to one's mind is not necessarily the best. On the other hand, there is always some danger and much difficulty to overcome when departing from the standard tried-out methods of operating, and there is a great deal of truth in the saying that "old shoes give little trouble."

Once the metallurgical process and the size of the plant have been determined, it is necessary to choose the site and decide about the general arrangement. It is so easy to move a plant around at that stage of the game. It is possible to shift it up hill or down hill, to turn it east or west; the building can be stretched or compressed; the roof can be raised or lowered with a stroke of the pencil. No physical effort and no expense are involved in moulding an idea, but a mental strain is often more taxing than a physical effort. There are few men who have the strength of mind and the willingness to consider the possibility that all may not be for the best when once the

general plans have crystallized. One day spent in thinking may save a fortune in operating expenses; it looks almost as if there should be so much to think about in designing a large plant that one could never finish perfecting the fundamental ideas.

Once, however, these have crystallized, the next step is to begin to draw the plans. And here a great danger lurks: the danger of falling in love with one's own drawing. My experience has been that every drawing should be drawn at least three times: the first drawing crystallizes the idea from the abstract to the concrete form; the second drawing brings out the structural defects; and the third gives a satisfactory solution of the problem. Sometimes, however, it is necessary to make a drawing ten times over; it may represent a week's work, but what is that expense to the cost of a \$100,000 or even a \$10,000 structure? Nevertheless, I have seen engineers rebel against re-drawing plans that could still be improved, just because the tracings were finished with all their titles and frills. Drawings are nothing more than pieces of paper conveying an idea; the paper is nothing and the idea is all; therefore if the idea is worthless the drawing may be scrapped. It is a good plan to cover one's second drawing with tracing paper and sketch and draw on this the *n* solutions of the problem in question; by so doing the main drawing remains untouched and much material work is saved.

Leaving now these generic considerations let us analyse the general structure of an ore-dressing plant.

There are two distinct stages in ore-dressing: in the first stage the run-of-mine ore undergoes a process of crushing, which reduces it to a size suited for dressing; in the second, the ore is subjected to a series of selective operations with the object of segregating a certain number of merchantable products.

The first stage of operations does not involve any metallurgical problems: it is merely a question of breaking rock as cheaply as possible. In former days it was usual to accomplish this work in the mill itself, as is still done in small plants; this makes it necessary to place the ore bins and some of the heavy crushing machinery on top of the mill. Heavy and costly substructures become unavoidable, the storage capacity of the bins cannot be large and the heavy crushing machinery causes a deplorable shaking of the whole mill structure. The modern practice is to keep the crushing and sampling plant entirely separate

from the mill and it becomes then quite immaterial where the crushing plant be situated. At Ray (Arizona) the crushing plant is near the mine; the ore, crushed to one-inch size, is conveyed by railroad cars to the mill, which is some 19 miles from the mines. There are many advantages in keeping the crushing plant entirely separate from the mill. First of all, it becomes possible to make use of large storage bins, which necessarily have to be built on the solid ground. The mine-bins, the crushing plant, and the crushed-ore bins can be placed along a hillside so that the ore can travel through the plant by gravity. The handling of dry coarse ore calls for a great deal of mill-head and it is generally impossible to place a mill in such a position that there will be sufficient head available for both the crushing plant and the mill. In most cases, therefore, it becomes necessary to elevate the ore at least once, and if this elevating is necessary, it is well to do it on such a scale that no subsequent re-elevating will be required. The separation of the crushing plant from the mill affords a good opportunity to do so.

Besides these considerations, there are additional advantages. It must be noted that the handling of dry ore is cheaper than the handling of wet ore: the wear on the crushers, rolls, screens, elevators, and so forth, is much decreased when the ore is dry, the reason being that when treating dry ore all the wearing parts become coated with splinters and particles of rock; these, in a certain way, protect the steel from the impact of the coarse pieces of ore; water keeps the wearing surfaces clean and increases abrasion in the same way as water on a grindstone accelerates the sharpening of a piece of steel. Rolls that are run dry will corrugate much less than if fed with wet ore, and the sampling also is much more reliable when done on dry ore. It is therefore highly important to do as much as possible of the crushing, elevating, sampling, and screening, before wetting the ore.

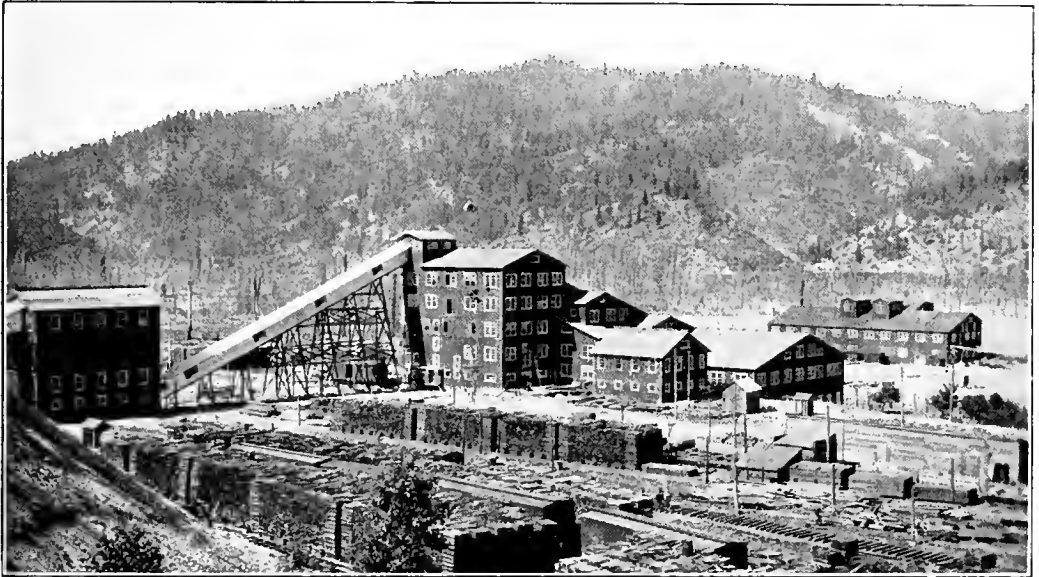
In addition to this, the preliminary crushing to small size allows a thorough mixing of the ore, an even distribution of it through the mill bins, and greatly increases the uniformity of the mill-feed both in quality and quantity.

The dust raised in crushing a dry ore is another factor of great importance in keeping the crushing plant entirely separate from the mill. The fine dust will travel a great distance, and, where the crushing is done in the mill itself, it will gradually settle in every part of the mill, causing much annoyance and trouble with all the machinery. Shaft-bear-

ings will heat, belts will slip, dirt will form everywhere, and even the window-panes become coated with an opaque film that interferes with the illumination of the interior.

The division of a plant into separate and distinct buildings may be carried out even further than this. It has always been my opinion that in mills where the ore is crushed by stamps, amalgamated, and concentrated, it would be a good policy to keep the stamps in a building entirely separate from the rest of the plant. The stamp-batteries are usually a unit by themselves, completely independent from the concentrating department, and the

amalgamation. These facts are now disproved. In several plants on the Rand the plates were removed from the batteries to a separate building, and though the plate-area was somewhat reduced, the amalgamation not only was not impaired but in several instances has even been improved. When stamping through a coarse screen and re-grinding in tube-mills, the removal of the plates from the stamps becomes imperative. In addition to this the hanging-up of the batteries and the dressing of the plates do not interfere with each other, and the repairing of the batteries is made easier.



THE BUNKER HILL & SULLIVAN'S WEST MILL.

separation of the stamping and the concentrating plant presents no serious drawbacks. Many advantages are gained instead. The deafening roar of the stamps is removed from the concentrating department, which roar, as well as the violent vibration imparted to the building, tells a great deal on the spirit and health of the men. Besides this, the vibration of the building interferes with the settling-tanks and frequently does harm to the machinery, piping, lighting-circuits, and so forth.

It has been generally considered that amalgamation is improved if the plates receive the discharge directly from the battery-screens. The arguments brought in favour of this were that the distribution of the pulp was more uniform and that the wave motion of the pulp and the vibration of the plates assisted amal-

The settling-tanks and pulp-thickeners are another part of the mill-equipment that can be conveniently placed in a separate building. Settling-tanks are heavy and bulky and generally are in the way if placed in the middle of the concentrating-floor. Most slime will run on a grade of less than a $\frac{1}{4}$ inch per foot, and therefore the loss in mill-head required in conveying the slime to the settling-tanks and then returning the pulp to the mill, is not great and can usually be afforded. In Arizona and other warm countries the tanks are placed in the open air, and this represents a considerable economy in the cost of buildings.

It must not be inferred, however, from what has been said, that the segregation of a plant

*W. R. Dowling. Jour. C.M. and M. Soc. S.A., vol. XI, page 414.

in separate buildings is an advantage; usually it is the contrary. There are great advantages in having as much of the machinery as possible under the same roof. A fine illustration of this is the Miami mill, designed by Kenyon Burch. There are many other mills built on the same principle, but at the Miami the frame of the building has been designed in such a manner that the view remains unobstructed from one end of the mill to the other. The rolls, grinders, classifiers, and the several table-floors are arranged in successive steps, and this orderly array of machinery is covered by a high roof, which gives to the mill distinctly the appearance of an exposition machinery-hall. There are many other modern plants of which this cannot be said, either because the roof-columns, launders, and transmission machinery form such an intricate network that the eye cannot reach far, or because the several units that constitute the mill form practically so many separate buildings.

In mill-design there are æsthetic principles just as well as in any other constructive art; it is a poor mind that cannot see the necessity of harmony and proportion in the design of an industrial plant. Anything that is perfect is beautiful and the pleasing appearance of a plant is usually an indication of efficiency. The beauty of a mill does not lie in artistic features, but in its fitness for the purpose for which it was designed. A thing that is excellently adapted to the purpose for which it was designed, is beautiful; therefore, proportions, general arrangement, facility and economy of operations, good illumination, and so forth, are all features that contribute toward efficiency and so toward beauty. To analyse all these items would lead us too far. What I wish to emphasize is that sufficient pains cannot be taken in studying the relative position of mill-machinery, and in considering which of the many solutions possible is that which will be best suited to the purpose. When everything is still on paper, a mill can be moulded as if it were clay. It is then that this moulding must be done, and not later when the mill is erected.

Leaving now these general considerations, let us examine the more practical features of mill-design.

First to be considered are the materials of construction; the three of which we make chief use are concrete, steel, and wood. During the last decade concrete has almost completely replaced masonry in all foundation work, and is being used more extensively not only in the construction of floors, bins, and so forth, but

even in the construction of jigs, settling tanks, launders, and other mill accessories. Concrete constructions have a long life but are not plastic, that is, they cannot be moved around nor easily modified, and therefore must be confined to plants that are permanent in character and where the metallurgical process has been completely elaborated. It would be a mistake to use them where a mill is still in the experimental stage; wood is much better suited in such cases, as it can be bored and sawed and patched without restraint.

Concrete foundations, however, are almost always advisable because they give to any structure a stability and rigidity that cannot be obtained in any other way; the advantages derived are so great that the additional cost of the concrete foundation will be repaid in a short time. Stamps, Chilean mills, and rolls are now always placed on concrete. Millwrights and manufacturers are realizing more and more that all concentrating machinery must also be placed directly on concrete foundations. I have placed Wilfley tables on heavy timber-frames securely bolted to the concrete, but have found that however well the work was done, there would still remain an objectionable spring in the foundation. Any reciprocating machine, be it a vanner, a Wilfley, or a Deister table, must be placed, if possible, on concrete; only then can complete rigidity of the foundation be obtained. The effect of this rigidity is to give a greater efficiency to the differential motion of the table and to increase to a remarkable extent the life of the machine. As example, let us consider a Deister table. This machine has a sharp differential motion; the stroke is not much over half an inch, and the efficiency of the machine depends on the suddenness with which the deck will return from its first position; as this return is almost instantaneous, the inertia of the deck develops a heavy strain on the head-motion, and, if this is not rigidly anchored to the foundation, there will be a 'give' in the head-motion that will detract from the efficiency of the stroke.

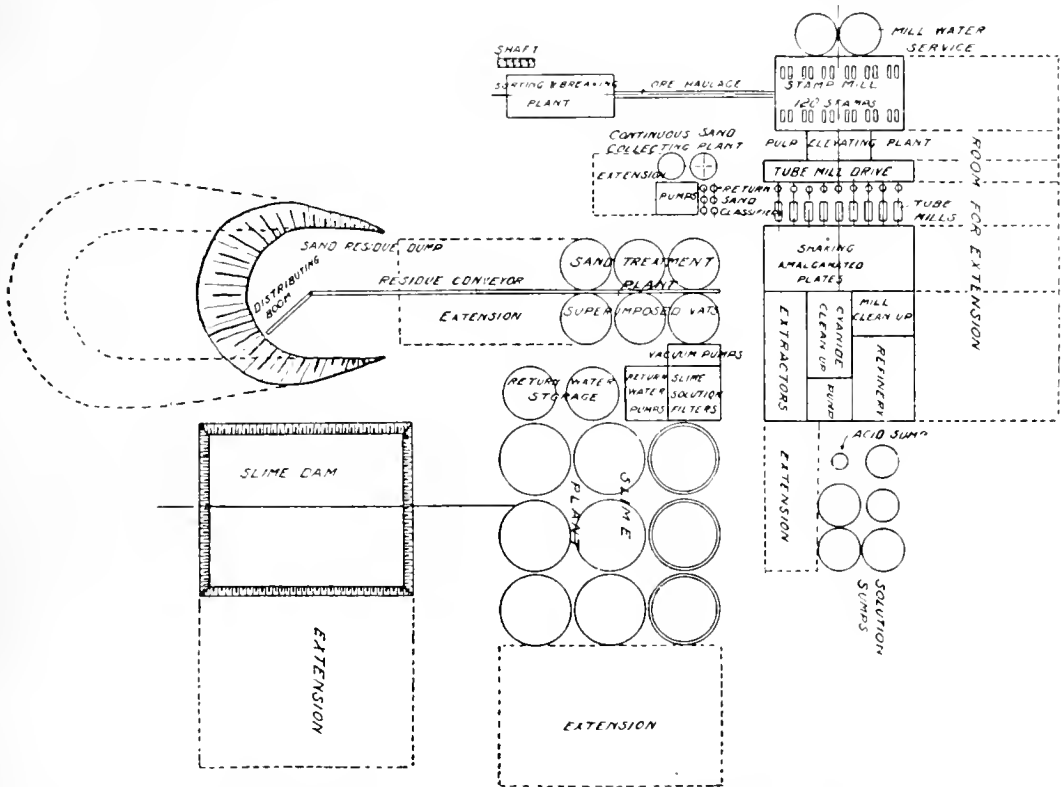
One great advantage in concrete foundations is that the rotting of the timber due to the moisture of the ground is almost eliminated. It is well to guard against this even when using concrete foundations, because if the ground is wet the moisture will rise by capillarity through the concrete and cause the rotting of the overlying timber. In such cases it is well to place a steel plate between the concrete and the wood.

Steel is now generally being used, and,

though steel structures are as a rule more costly than wooden structures, the difference in cost is not as great as one would think, especially in countries like Arizona, where good structural timber is expensive. In dry and warm countries, where it is not necessary to provide against heavy snow-falls, there is a decided advantage in using light and flat roof steel-structures with long spans. Steel buildings are also more rigid; they do not sag and twist as wooden structures will do while dry-

easier than steel, and it should be used by preference in all small plants, especially in those where frequent changes are liable to be made. In addition to this, in several districts it is by far the cheapest building material available: frequently it can be obtained locally, whereas steel beams would have to be brought from great distances and at considerable expense.

A combination of steel and wood offers remarkable opportunities for designing elegant structures. It is a pity that the combination



A MODERN MILL ON THE RAND (From 'Hand Metallurgical Practice'.)

ing out or when subjected to heavy loads. Fire protection is another advantage obtained, especially when concrete floors are used in connection with the steel frame. It must be remembered, however, that mills built of steel generally are not any more fire-proof than an ordinary office building; the structure itself may be fire-proof, but it generally contains so many combustible accessories that, once a fire gets started, it can do great damage. Many will remember the serious fire at the Goldfield Consolidated mill. With all this, wood is still the material most commonly used in mill construction, owing to the fact that it can be framed and erected so much

is so seldom used. In these structures steel ought to be employed for such members as are subjected to the heaviest strains or where long spans offer special advantages in the general arrangement of the machinery. Steel beams will give a rigidity that cannot be obtained even by using heavy timbers and often offer simple solutions for structural problems when the available head-room is limited.

On the other hand structures that are entirely built of steel are inelastic, that is, every detail has to be accurately determined beforehand, and there is no opportunity to introduce such small changes as frequently become advisable during the course of construction or operation.

For example, where the transmission-bearings are directly bolted to the roof-trusses, it becomes difficult to change the position of a bearing, and the alignment of the shafting has to be made by special adjustments on the bearings. It is good practice in such cases to use intermediary timbers, that is, to bolt heavy timbers on the steel trusses and to attach the shafting, launders, and so forth to these timbers. Changes and additions are then easily made without requiring the help of mechanics and the laborious manipulation of an 'old man.' Intermediary wooden bed-plates can also be used to advantage between concrete foundations and electric motors, Huntington mills, and rolls, for the reason that often in changing or replacing these machines a different spacing of the foundation-bolts is required.

Let us now consider the general arrangement of a mill. A hillside is generally the best situation that can be chosen, because it allows of the arrangement of the various floors in descending terraces, so that the ore can flow by gravity from one machine to the other. It is a mistake, however, to believe that no hillside mills require any re-elevating of the ore. There are doubtless cases where the secondary machinery, that is, the machinery used for secondary treatment of the ore, as for re-grinding and re-concentrating, can be so disposed as not to require any further elevating of the pulp; but in most cases such arrangement detracts from the uniformity of the mill arrangement and causes machines of the same kind to be scattered over different floors, or even may make it necessary to place some machines in dark and inaccessible places.

When re-elevation becomes necessary or advisable, it is a good plan to concentrate this operation as much as possible into a few large units; in other words, it is better to elevate the pulp in one step to a considerable height rather than to cause it to be elevated several times in succession, even if each lift is a comparatively small one. Every piece of machinery will give its share of trouble, and generally a machine of great capacity does not cause much more trouble than a small unit. Therefore it is well to concentrate operations, not only in the case of pumps and elevators but also with other machinery in the mill. All machinery that has an important organic function, whose failure would involve a suspension of operations, ought to be installed in duplicate. This is a fundamental principle. If now the elevators, pumps, classifiers, and so forth, are too numerous and are scattered here and there, it becomes practically impos-

sible to have them all in pairs, whereas if a few large units are used, they can usually be installed in duplicate. This principle is of even more importance in mills that have flat sites than in those that have a natural slope.

The arrangement of all machinery of one kind on one floor is important for obvious reasons. It greatly reduces labour and increases the efficiency of operations. The linear arrangement, whereby all machines are placed in a row, is also of great importance because it establishes a parallelism with all the machinery that precedes or follows, and allows an advantageous arrangement of the launder system and a corresponding economy in mill-head.

It is well to economize space in the direction in which the material flows, because this saves the mill-head; but it is a mistake to exaggerate this, as space is required around every machine, and the more space the better. I would say there can hardly be too much space; it assists operations and repairs, besides giving to the plant a pleasing appearance, which is instrumental in keeping up the standard of the work and the spirit of the men.

Main alley-ways are necessary because they establish thoroughfares of circulation and permit machinery to be moved through the mill without interfering with operations. All multiple and important machines, such as rolls and Chilean mills, should be placed in a row and provided with a crane or trolley, by means of which the heavy parts can be lifted or removed. When designing a mill one must remember what happens during operation as well as provide for the moving of the machines during construction. A tube-mill cannot be carried through the air and gently deposited on its foundations; it has to be placed on skids and moved with pinch-bars and rollers; it would be improvident therefore to neglect an alley, or some opening, through which it may be passed. I have seen an instance where to get a certain machine into place it became necessary to dismantle half the mill.

In the relative arrangement of the machinery, it is important to bear in mind what may happen or may not happen during the course of operations. To begin, a launder will occasionally choke, even if it has plenty of grade; once I found that a 'jumper' had been forgotten in a launder after a general clean-up—and that is more than sufficient to cause trouble. When a launder overflows it will spill grit and sand over everything, and if it falls on the working part of a machine, need-

less to say, it will do damage. So also will classifiers, pumps, elevators, Callow tanks; and the only way to avoid the trouble is *not* to place any machine under anything that can overflow. This is an important and much too frequently neglected principle. I have seen one of the most modern plants in the West, which has only been in operation a short time, where the feed launders to the reciprocating tables run right over the head-motions, with the result that these practically new machines are completely worn out.

In such cases the fault is due not so much to bad planning as to insufficient planning. It is necessary to know exactly where everything will go; otherwise, when the not-planned items are installed, there will occur unforeseen difficulties that cannot be solved except by crude makeshifts. If the super-position of machinery is imperative, for example, if a classifier has to be placed above the concentrating tables, it becomes necessary to provide a waterproof floor. This can be done, even though most millwrights will agree that an impermeable wooden floor is difficult to build.

One of the most important problems to be determined in the design of a mill, and one of the most difficult to solve correctly, is that of the circulating system. In the first place, it is necessary to determine accurately the tonnages of the various products into which the run-of-mine will split after passing through the breakers, screens, and classifiers. There is one correct way of doing this, and that is to measure accurately these tonnages, either in some plant similar to the one to be designed or by making tests on a large scale. Screen-tests made by hand are fairly reliable for sizes coarser than 7 mm., because coarse screening machinery is usually efficient, and therefore will closely approximate hand-screening. On finer sizes, laboratory tests and theoretical calculations are quite unreliable, because in practice the efficiency of fine screens is variable and always far from perfect. The tonnages of classified discharges, slime-separators, and so forth, cannot be calculated theoretically with any degree of accuracy.

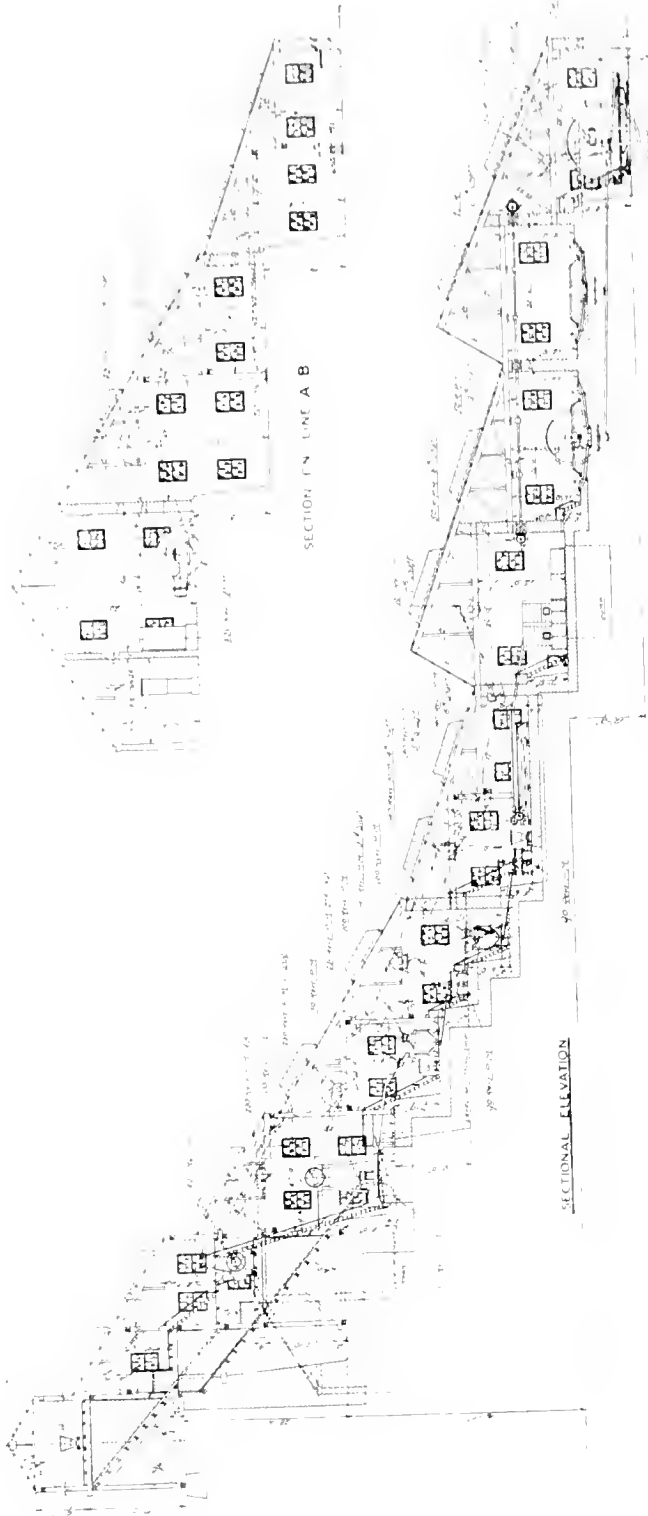
Whatever be the method applied in determining the relative tonnages of the mill-products, it must always be kept in mind that the normal expected load is to be taken as the minimum load. Provision must be made for the occasional handling of thrice the average load, and both the machines and the circulating system must be capable of handling this overload without disaster. This is where the capacity and the elasticity of the mill-machin-

ery comes in. Nothing is permanent or uniform in nature, and wherever there is movement there are pulsations. You can watch the operation of a jig, of a classifier, of a table, or even of a launder, and you will notice continuous pulsations. As an illustration, I will take the feed to a coarse concentrating plant.

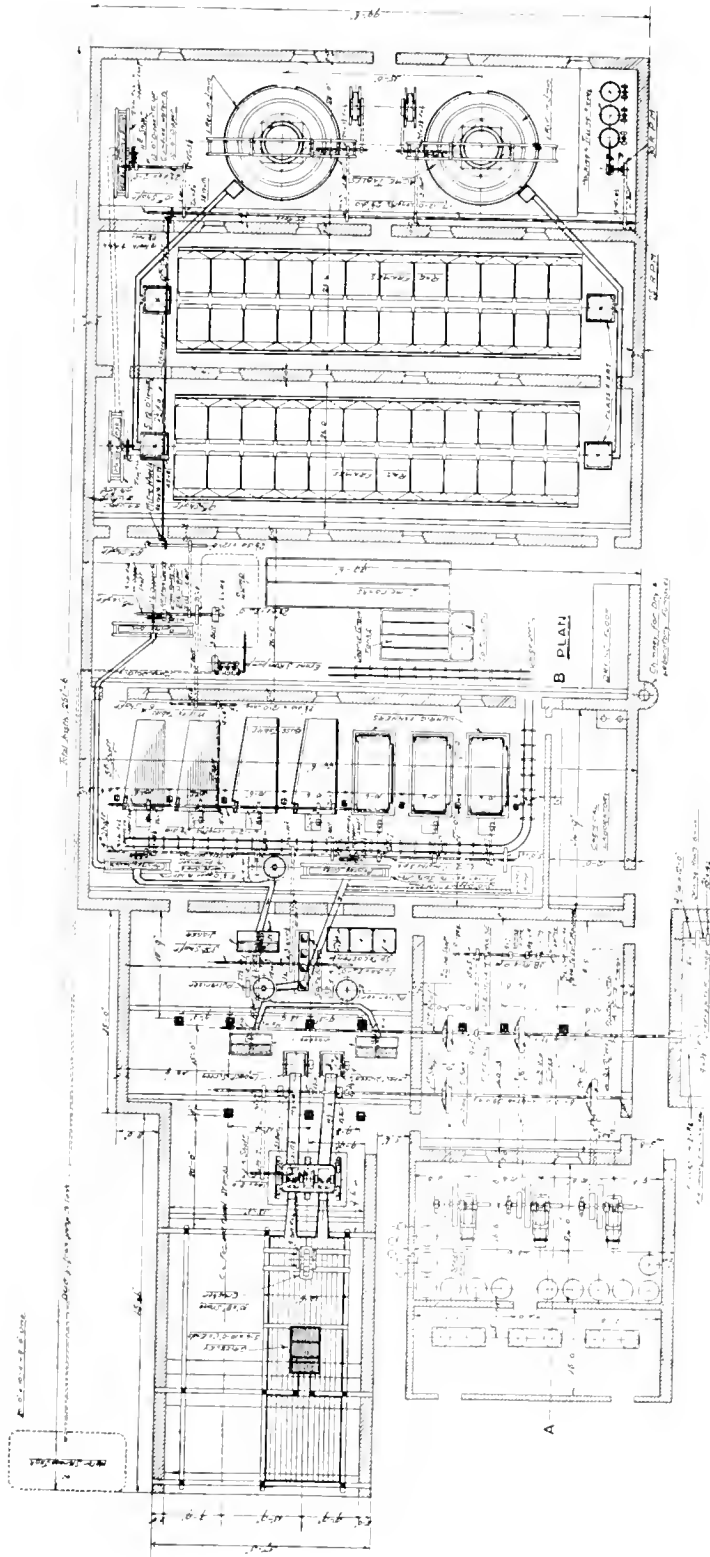
When the ore is being dumped into the mill-bins it will pile into the shape of a cone; the coarse material, which rolls more easily, will distribute itself round the base of the cone, whereas the fine material will have a tendency to concentrate and accumulate along the axis of the cone. When the content of the bins is fed to the mill, there will always be moments, in the 24-hours cycle of the operation, when a large proportion of the feed will be coarse, and other moments when the machinery handling the fine product becomes overloaded.

To these natural fluctuations in tonnage must be added the artificial and accidental ones. In mills where some of the circuits are closed, that is, where some products are being returned to the same machinery through which they have already passed once, it occasionally happens that the material begins to circulate in a vicious circle and gradually increases in volume until radical measures have to be taken to relieve the congestion. Usually it is difficult to remedy this, as the conditions causing the idle circulation are generally accentuated by the very fact that the circulation is congested. As an example, let us suppose that the over-size of a trommel is being sent to a set of rolls, the discharge of which is returned to the trommel. If the trommel becomes blind or the rollers are not crushing sufficiently fine, an idle circulation sets in. The overload on the trommels will render the screening less effective and increase the proportion of over-size thrown to the rolls; this in turn overloads the rolls, which become inefficient and cause a large proportion of oversize to be returned to the trommel.

Some degree of elasticity in the flow-sheet of a mill is necessary not only to provide against the fluctuations in tonnage, but also to allow the cutting-out of some of the machinery for repair. The close circuits just mentioned are generally objectionable; at times, however, it is well to make provision for establishing a close circuit, as by such an arrangement it becomes possible to relieve temporarily the load in one part of a mill, or even to take care of some products while short repairs are being made to some machines. All close circuits represent a storage capacity, of which use can be made in moments of need.



A MODERN TIN-DRESSING PLANT AT CHOROLOQUE, BOLIVIA.



PLAN OF TIN-DRESSING PLANT AT CHOROLQUE.

It has been previously mentioned that all important circulating organs of a plant ought to be in duplicate: the Chilean mills, tables, launders, and other parts of the mill naturally cannot all be built in duplicate, but it is essential that their arrangement should be so disposed as to allow the liberating of one of them when repairs are required. This can be done by using feed-distributor switches and by many other devices, which it is impossible to discuss here in detail. The provision of all these details will give to a plant an elasticity that will ensure continuity of operations and increase the efficiency of the plant while saving at the same time much trouble and work.

The subject is such a wide one that the discussion of all the main principles of mill-design, not to mention the details of their application, would call rather for a book than for a brief chapter. I have chiefly taken up the subject from the point of view of an engineer who is planning the erection of a new mill. New mills, however, are not built every day. Far more frequently an engineer is called upon to re-model or repair a plant that already exists, and may be expected to carry out his work without suspending or even interfering with operations. This is troublesome work, much more difficult than building an entirely new mill. There are no rules that can be followed in this work, and the engineer has to rely more on his own ingenuity than on theoretical ideas and school-books. Not only is it the most difficult work, but it is that which comes first in one's experience: and it is only later, generally after many years of hard work, that one gets the pleasure, and a pleasure it is, to start with a free hand on the design of a new mill.

World's Copper Production.

We quote the following statistics relating to the production and consumption of copper throughout the world from the yearly report issued by Aron Hirsch & Sohn, Halberstadt, Germany.

TOTAL PRODUCTION OF WORLD.

Year	Long Tons	Year	Long Tons
1800.....	10,000	1898.....	424,100
1830.....	30,000	1899.....	470,900
1880.....	154,000	1900.....	486,000
1885.....	225,600	1901.....	516,600
1894.....	324,000	1902.....	541,100
1895.....	334,500	1903.....	580,000
1896.....	373,300	1904.....	644,800
1897.....	397,400	1905.....	693,700

Year	Long Tons	Year	Long Tons
1906.....	741,654	1910.....	857,150
1907.....	702,044	1911.....	869,370
1908.....	746,585	1912.....	1,008,290
1909.....	834,940		

PRODUCTION OF COPPER BY COUNTRIES DURING 1911 AND 1912.

Country	1911 Long Tons	1912 Long Tons
United States.....	487,300	557,590
Mexico.....	54,050	71,980
Japan.....	55,000	65,000
Spain and Portugal.....	55,000	58,000
Australia.....	44,600	45,500
Chile.....	29,600	37,000
Canada.....	24,000	33,500
Russia.....	25,500	33,000
Germany.....	30,500	30,510
Peru.....	26,000	27,400
Sweden and Norway.....	9,500	10,000
Cape Colony.....	7,000	7,000
*Serbia.....	—	6,000
**German S.W. Africa....	—	6,000
**Austria-Hungary.....	2,520	3,960
Italy.....	3,000	2,350
Bolivia.....	2,500	2,000
Newfoundland.....	2,100	1,000
Turkey.....	700	500
Miscellaneous.....	10,500	10,000
	<u>869,370</u>	<u>1,008,290</u>

*Hitherto included in 'Miscellaneous.'

CONSUMPTION OF COPPER BY COUNTRIES DURING 1911 AND 1912.

Country	Long Tons 1911	Long Tons 1912
Germany.....	234,229	253,429
France.....	106,997	106,753
England.....	159,736	148,877
Austria-Hungary.....	40,000	51,574
Russia.....	31,845	38,818
Italy.....	30,437	34,378
Belgium and Holland..	13,000	13,000
Scandinavia.....	7,500**	7,500**
Rest of Europe.....	2,500**	2,500**
Europe :.....	<u>696,244</u>	<u>656,829</u>
North America.....	316,791	365,922
Rest of America.....	3,000	3,000**
Europe and America :	946,035	1,025,751
China.....	4,500**	4,000**
Japan and rest of Asia	21,000	27,000**
Africa and Australia....	2,000**	1,000**
World's Consumption..	<u>973,535</u>	<u>1,057,751</u>

**Estimated

TRAVEL IN CENTRAL CHINA

A Mining Engineer's Journeys in Hupeh and Hunan ; with Notes on the Geology and Money Systems.

By E. C. THURSTON.

HUNAN.—One of the main rivers of Hunan province is the Hsiang, which flows north through Tung Ting lake into the Yangtse. At the time of our visit, at the beginning of December, 1903, the rivers were falling rapidly and the regular steamer service between Hankow and Chang Sha Fu, the capital of Hunan, had been discontinued. We chartered a launch to take us as near Changsha as the depth of the water would permit, and, after transferring to a small cargo-boat about 24 miles below Changsha, reached that place four days after leaving Hankow.

near Yo Chow Fu at the confluence of the Hsiang and the Yangtse.

Our objective point was near the headwaters of the Mi Shui river, northeast of Changsha, and near the boundary of the province, in a range of low mountains. Between Changsha and the mountains the country was well populated and thoroughly cultivated. Red sandstone, grit, and conglomerate underlie the fields, nearly horizontally bedded but forming occasional low mounds. This sandstone series overlies the coal measures of southeastern Hunan. Near the foot-hills we



In travelling chair crossing river.



Conglomerate hills near Chang Sur Kai.

Our caravan for the land journey comprised 3 foreigners, 5 Chinese gentry*, of whom 3 were interpreters and 2 guides, 2 cooks, 8 body-servants, 9 soldiers and yamen runners, 2 head coolies ; 68 chair-coolies and 48 baggage coolies ; a total of 145. This made an unwieldy party. The total distance covered was about 260 miles, and the average and best days' marches were 24 and 30 miles respectively. The highest point reached was about 800 feet by aneroid above the river

saw some isolated conglomerate buttes with sheer walls many hundred feet high rising from the rice fields. The mountains are formed of steeply tilted slates containing some auriferous quartz veins, but the mountain streams were scarcely at all worked by the Chinese, all the placers under exploitation being along the rivers in the flat country below.

East of Chang Sur Kai some placer mining is done in the broad valley of the Mi Shui. The bed of this river is sandstone as far west as Ping Kiang Hsien, but below that town slate outcrops again, reducing the river valley

* A Chinaman of the Mandarin class speaks of himself as a 'gentry.'

to a gorge and rendering even shallow-draft navigation impossible at low water. During high water the Mi Shui may be navigated as high as Chang Sur Kai. In the neighbourhood of Kwei Yi the red conglomerate appears once more and extends north as far as Yo Chow, except for some large hills of slate, which shows outcrops near that city. From Kwei Yi nearly to Yo Chow we followed the Imperial post-road, which connects Canton with Peking, passing through Changsha. This road was broader than usual, but not sufficiently broad for carts, and was in bad condition.

We took a short cut to Yo Chow across an arm of Tung Ting lake, then dry, went on to the custom-house north of the city, paid-off our soldiers and coolies, engaged passage in a tug, and arrived at Hankow a day and a half later.

HUPEH.—From I Chang Fu, the head of steam navigation on the Yangtse, we travelled overland in a northwesterly direction about 350 miles and returned by boat to Hankow, along the Tou and Han rivers. Our party for the land trip comprised 4 foreigners, 5 Chinese gentry, of whom 2 were interpreters and 3 guides, 5 body-servants, 2 cooks, 2 or more yamen runners, 6 or more soldiers, 2 head coolies and 72 chair and baggage coolies, in all from 98 to 106 men.

The first day out of I Chang we crossed strata of reddish sandstone and conglomerate, which are characteristic of that neighbourhood, into a hilly country of shale and limestone overlying the sandstone. During three days our route paralleled the strike of the limestone and shale strata, a little west of north. The dip was gentle to the east. There was a range of mountains two or three thousand feet high to the east, probably the Yu Ku Shan, in which the lines of stratification were distinctly seen. The numerous small streams flowing west from the west flank of this range have cut ravines in which some good exposures were observed of conformability between the intercalated strata of fissile splintery shale and richly fossiliferous limestone, said to be Jurassic.* On the afternoon of the fourth day out of I Chang Fu we came into red conglomerate again, only to pass back the next day into limestone and shale, showing that we were roughly following the contact of these formations. The night of that fourth day on the road we spent at a small town named Ma Nan Ping, situated on the west bank of a large stream flowing south through a fertile valley surrounded by high hills of conglomerate.

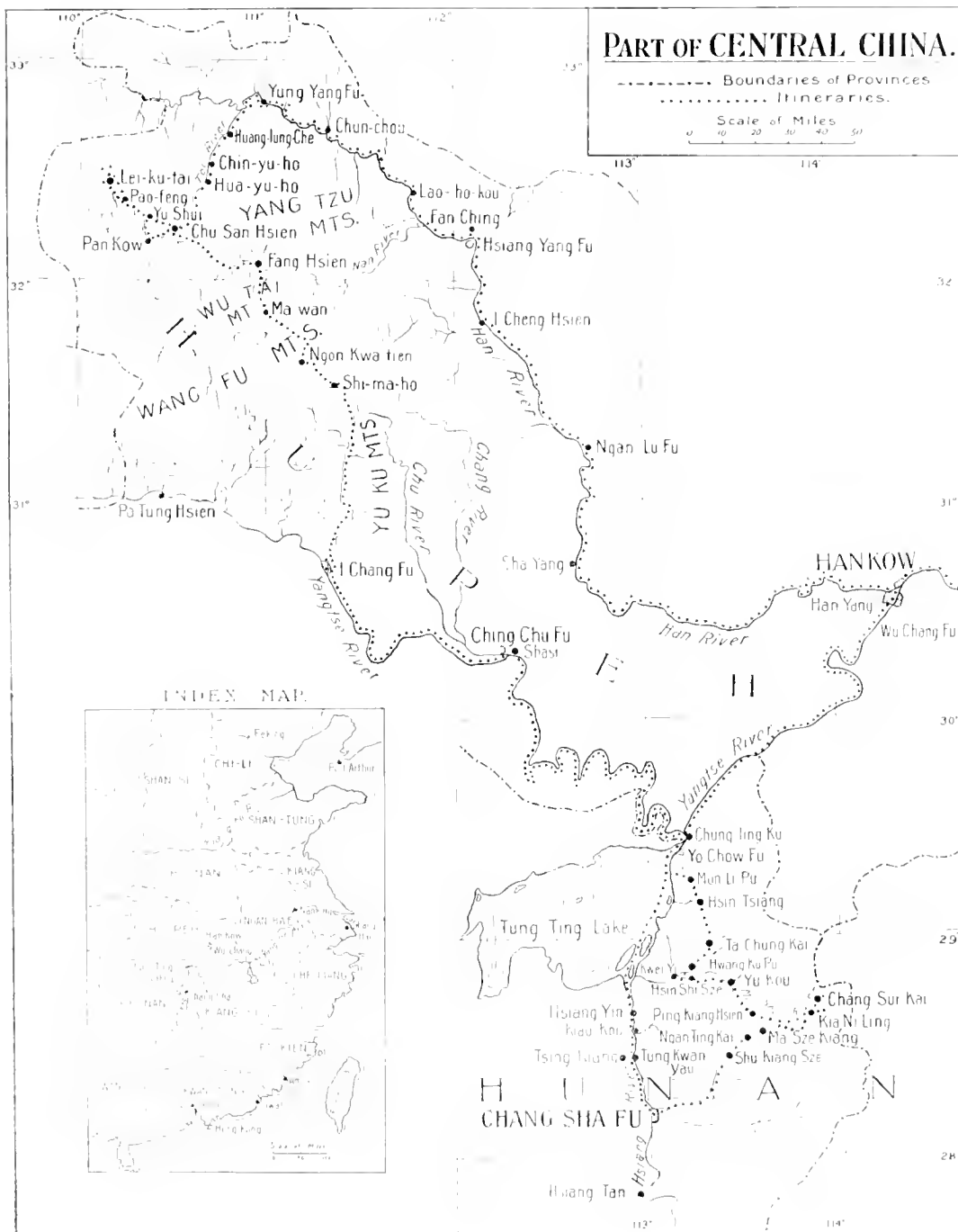
According to our maps this stream should flow north into the Nanho, but, having begun to lose faith in the maps, we questioned the authorities here and the next day at Hsie Ma Ho, which is on the same river. To all our questions we received one or the other of two replies: first, that there was water connection by this stream with Sha Si on the Yangtse, not, as we suggested, by the Nan and Han rivers, but direct; second, that the river flowed south a little way and then disappeared! We were frequently told of rivers in this part of Hupeh that penetrated the limestone range through underground caverns.

From I Chang to Ngon Kwa Tien, a small village at the foot of the Wang Fu mountains, the country-side appeared fairly prosperous, rice being the staple food of the people, who were always polite and good natured, though inquisitive. Many high shale hills were crossed, steep and slippery, and utterly impracticable for any vehicle. All freight is carried by coolies on the pole slung across the shoulders or in baskets on the back.

The Wang Fu Shan is a range of limestone mountains, the eastern extension of the Ta Pa Shan, and forms the watershed between the Yangtse and Han rivers. It rises some 3000 ft. above the valley south of it, affords some striking views, and marks that part of the limestone formation where the strike of the strata changes from north-south to east-west, and the dip from east to north. From the top of the pass until we reached Tsung Tai Kou on the afternoon of the seventh day on the road, the path was very bad, and during high water would be impassable. It threads the rocky beds of streams flowing through wild limestone gorges affording scanty areas for cultivation. The thickness of the strata exposed must be many thousand feet. The country people were poor and lived on corn. The only industry seen, aside from the small amount of agriculture, was small paper-mills using water power. Trees, which in general are rare, were numerous here, and wild chrysanthemums were blooming,

At Tsung Tai Kou we reached the Nan river, or a southern branch of it, beyond which the character of the country changed to easy rolling slopes under considerable cultivation. The rocks were shale and slate. The eighth day out we skirted the northern edge of the limestone keeping in the slate, crossed a high shale ridge, the Wu Tai Shan, and during the afternoon passed through a little valley where jasper and ironstone conglomerate were seen in sufficient quantity to indicate the possibility

*Deccanial Report Imperial Chinese Customs. Page 256.



coolies, whose wages were the same, 'squeezed' the coolies' pay as it passed through their hands. Assuming the coolies returned unloaded in half the time required on the inward trip, their theoretical wages amounted to 6d. per day. The soldiers and Yamen runners carried no loads, and received in wages 6d. per day while with us, and a tip on leaving. Riding ponies and pack mules were hired for a side trip from Hsiang Yang Fu at 1s. 9d. per day per animal.

Our lodgings on this trip were always in temples, and cost on the average, with candles, firewood, and water, about 13d. per foreigner per day. This included lodgings, etc., for the Chinese gentry. Our food-cost of about 9d.



Travelling on the lower Han river.

per day per man covered such provisions as eggs, chickens, ducks, pheasants, fish, rice, and vegetables. Cumquats and persimmons, the latter very fine, were the only fruit obtainable.

On both the Hunan and Hupeh trips we took many cases of tinned foods and bottled water, much of it unnecessary, as fresh food was easily obtainable on the journey. During the autumn and winter, game birds are plentiful. The most necessary provisions we found were foreign candles, soap, eating utensils, soups, coffee or cocoa, sugar, condensed milk, biscuits, potatoes, and a limited amount of bottled water. It is essential to have one's own bedding, and well to have plenty of strong Chinese oil-cloth to protect the bags and bedding from rain and to spread under the beds at night. Insects have a fortunate aversion to the smell of it.

The average Chinese interpreter is a good fellow, but must be taken with a grain of salt. He may be quite honest in money matters, but his interpreting cannot be regarded

as reliable without repetition and corroboration, even when personal bias is absent. This is especially true if he be uninterested in the subject or in the dark as to the point of the questions. In travelling he never hurries, so, if speed is important, it is well not to be unduly influenced by the excuses given for delay; these are usually flimsy, and often quite entertaining.

MONEY.—Everyone who has travelled in the interior has experienced the annoyance caused by the different currencies used in the various parts of the country and by the diffi-



Chinese Woman on a journey

culty of obtaining accurate information beforehand as to the particular currency used in the district to be visited. The missionaries and custom officials have the best sources of information, but as both usually live in the larger towns their information is not always correct as to the country several days journey beyond. The 'cash' is used universally, but is much too heavy for exclusive use. Each coolie's wage for the Hupeh trip would have weighed over 50 lb. in 'cash'; he could not have carried much beside. A string of 1000 cash is called a 'tiao.' 'Sycee,' or bars of silver bullion, weighing from 6 to 60 oz. troy, are generally used, but are heavy and bulky, and the weight of each bar must be determined, and a hammer, chisel, and scales carried to chip off and weigh the amount required for each payment. The fineness is generally assumed to be uniform. Mexican and Chinese provincial dollars are more convenient, though just as heavy as sycee. Copper 10-cash pieces are minted in Hupeh, and are more convenient than

'cash' for small currency, but do not circulate everywhere.

It must be remembered that the rate of exchange varies not only between dollars and taels of 'cash,' but between dollars from different mints even where they circulate. The tael and dollar bank-notes issued by foreign banks in treaty ports were not used in the interior. A tael is worth 1000 cash, but is abstract as compared with a concrete tiao. Tiao notes were issued by the Imperial Chinese Bank, and possibly by other native banks. These were of two kinds, the old and the new; the new were smaller and cleaner than the old and more readily accepted. Drafts can be bought on all large cities of the interior.

On our Hupeh trip we used sycee and old and new notes, but the old notes were either refused or taken with reluctance and at considerable discount. With the new notes we had no difficulty. In Huanan we used Hupeh dollars at the rate of exchange into 'cash' agreed upon with our coolies before starting. Roughly 1 tiao or tael is worth 2s. 6d. to 2s. 9d., and a dollar is worth 750 'cash,' while about 32 'cash' equal one penny.

Before leaving Hankow for the Hupeh trip we obtained something over the amount of money that, from the information available, we thought would be required. During the two or three days spent in I Chang Fu collecting coolies, soldiers, etc., we found that we should need more money than anticipated. As there were then no regular banks in I Chang, we approached the official representative of the Imperial Chinese Customs, a Belgian gentleman, who courteously informed us that he was not authorized to honour a stranger's draft on Shanghai, and suggested that we should see the agents of the foreign shipping companies. So our next call was at the office of Jardine, Matheson & Co., where we were received by a Chinese gentleman who spoke fluent and excellent English. Here our former experience was repeated, apologies offered with cups of tea, and we were just leaving when he said "But stop a minute; aren't you gentlemen Americans?" "Yes." "I am glad to hear it. When I was a boy I went to school in Connecticut, and was always well treated. I cannot advance you money on the firm's account, but my private purse is at your command. How much will you need?" and he promptly supplied our requirements. That courtesy will be always pleasantly remembered. The general conditions of travel away from treaty ports are probably much the same today as those we found ten years ago.

Canadian Ore-Testing Plant.

The Canadian Government Department of Mines has established an ore-dressing and metallurgical laboratory at Ottawa, and it will be ready for opening in July. The plant will be operated free of charge on Canadian ores. The work will be usually done by the officials of the Mines Department, though under certain circumstances engineers may be permitted to supervise their own experiments. It is stipulated that the reports of tests shall be incorporated in the Government publications. Later in the year, an experimental roasting and sintering plant will be erected.

Some of the machines in the laboratory are of standard size, and others are small-scale apparatus. In the crushing department, there are the following: a Hadfield 12 by 8 in. jaw-crusher, Allis-Chalmers 24 by 14 in. rolls, Hardinge mill, Ferraris screen for coarse sizing, Keedy ore-sizer for fine sizing, and duplex Callow screen. The stamp-mill department contains 5 Allis-Chalmers stamps of 1250 lb. each, with various accessory amalgamating apparatus. The concentration department includes Richards' pulsator classifiers, Richards' pulsator jig, Overstrom sand-table, Deister slime-table, Callow tanks for desliming and settling, two Grondal magnetic separators, one working wet and the other dry, Ullrich magnetic machine for both dry and wet material, and Huff electrostatic unit. In the sampling room there are Vezin machines for coarse material, Flood samplers for fine material, Jones riffled sampler, and Keystone water-meters.

The small-scale apparatus consists of Sturtevant crusher, Sturtevant rolls, Braun planetary pulverizer, Abbé pebble-mill, Hoover gyratory screen, Richards combined pulsator jig and classifier, Grondal magnetic separator, Willfley table, Parral agitator having a capacity of 200 lb. with accessory plant, laboratory filter-presses, and screens of both the I.M.M. pattern, and the Tyler pattern based on the Rittinger scale.

The Bradley process for treating copper slime has not proved a success at Anaconda, and the experimental plant has been closed. The process, though ingenious chemically and mechanically, had the drawback of involving both unusual methods of work and unusual types of plant, while the introduction of a new nomenclature, containing such a word as 'amphidizing,' added an unnecessary element of mystification. We gave a detailed account of the process in our issue of April 1912.

PRECIS OF TECHNOLOGY

Laist's Leaching Process for Copper Ores.—In our February issue we made brief reference to the process now being developed at the Washoe plant of the Anaconda Copper Mining Co., Montana, for treating tailing by leaching. The *Mining and Scientific Press* for May 3 contains an editorial article on the philosophy of hydro-metallurgical methods in general, and on the Laist process in particular. This process was tried by Mr. Laist some years ago at the Indian Boy, in Utah, but the conditions were not favourable. The results at Anaconda have however been so successful that an experimental plant with a capacity of 80 tons per day is being built. The material to be treated is the average tailing from the wet-concentration plant, containing about 0.65% copper. This will be dewatered, and, when nearly dry, sent to roasting furnaces of the McDougal type, of which the upper hearths will serve chiefly for drying and pre-heating, while upon the lower hearths salt will be added in small quantity; the heat will be so adjusted that at the completion of the roast the copper will be in a form easily dissolved by the dilute sulphuric acid used for leaching, while the iron present will be in insoluble form. The roasted material will be leached in vats with dilute sulphuric acid, made by the chamber process from the sulphuric acid gases drawn from the roasters that treat the rich concentrate obtained in the concentration plant. The copper-bearing liquor will be removed by decantation, and the copper precipitated by passing sulphuretted hydrogen into the solution, precipitating copper sulphide and regenerating sulphuric acid which may again be used for leaching. The production of sulphuretted hydrogen would in ordinary cases probably prove unduly expensive, but at Anaconda there is available auriferous pyrite, from the Georgetown district, which would otherwise require treatment by direct smelting. This ore, by simple fusion, is reduced to iron matte, which can be utilized in the sulphuretted hydrogen generators. The consumption of sulphuric acid is thus reduced to the amount required for the production of the necessary sulphuretted hydrogen, with the added amount that will unavoidably be lost in foul solutions. As the acid can be cheaply made by the chamber process, it is confidently expected that a high extraction of the copper now being lost in tailing can be made at a cost not exceeding that by present methods. Should this plant prove a success, some modifications will be made in the present methods of wet concentration.

Tin-Dressing at Rooiberg.—The *South African Mining Journal* for April 19, describes the concentration plant at the Rooiberg tin mine, in the Transvaal. The plant was completed in the latter half of last year by the erection of machines for treating the slime. There are 10 stamps each weighing 2000 lb., and discharging through 8-mesh screens. The pulp, after passing an automatic sampler, goes to a Callow screen fitted with 20-mesh cloth. The coarse product is sent to two 3-compartment Hartz jigs, from which the head is sent to a Brunton furnace and the middling and tailing to a tube-mill. The underflow from the Callow screen is pumped to six classifiers, the underflow from which passes to six Wilfley tables and the overflow to the slime plant. The Wilfleys produce a head, middling, and tailing. The head goes to the Brunton furnace, the middling to the tube-mill, and the tailing to waste. The re-ground product from the tube-mill is pumped to six classifiers, from which the underflow goes to another set of six Wilfleys, and the overflow to the slime plant. The head from these tables goes

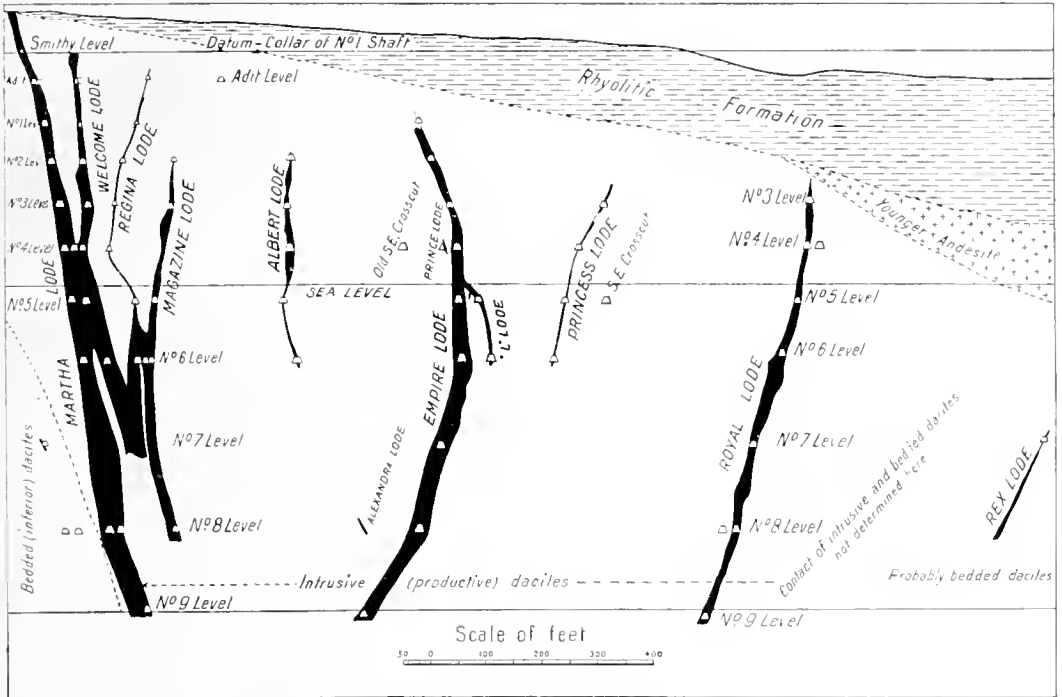
to the Brunton furnace, the middling to five Frue vanners, and the tailing to waste. The Frue vanners make a head which is sent to the furnace, while the tailing goes to waste. The slime from twelve classifiers is sent to three sets of 14 rag-frames and subsequently to revolving tables. Before the slime plant was erected the recovery was 58% of the metallic content of the ore, the extraction being 62 lb. metallic tin per ton and the loss 45 lb. Since the introduction of the slime plant the loss has been reduced to 13½ lb. per ton, and the percentage of recovery raised to 88%. Our contemporary draws conclusions between the recovery and Cornish results. We refer to this in our editorial notes.

Aluminium as a Precipitant in Cyanidation.—In the *Engineering and Mining Journal* for May 10, E. M. Hamilton describes the use of aluminium powder as a precipitant of silver from cyanide solutions at the Nipissing mine, Cobalt, Ontario. We have on several occasions referred to the cyanide method of extracting silver from the complex ores adopted at the Nipissing, with the object of obtaining silver bullion, instead of selling the ore and concentrate to smelters. When the plant was erected over a year ago, the Merrill process of precipitating silver from the solution by means of zinc dust was installed. It was found in the trial runs that the cyanide solution, after the removal of the silver by precipitation with zinc, lost its dissolving efficiency rapidly. Investigation showed that the presence of arsenic in association with zinc remaining in the solution was the cause of its deterioration, and it was then decided to adopt some other means of precipitation in place of the zinc. Electrolysis, sodium sulphide, and aluminium were considered. The first two have so many well known disadvantages that they were not tried, and attention was centred on aluminium. As far back as 1893, Moldenhauer drew attention to the advantages to be gained by aluminium as a substitute for zinc, the chief of which was the fact that as aluminium does not combine with cyanogen the whole of the cyanide is recovered in the process. On the other hand, for the same reason the use of aluminium renders necessary the presence of an alkaline oxide or hydrate, such as sodium hydrate. At about the same time as Moldenhauer brought forward his suggestion, Julian tried precipitation by means of aluminium sheets and subsequently shavings, but he found that the surfaces soon became coated with alumina which stopped the reaction. The first to use aluminium powder was Kirkpatrick at the Deloro smelter, Ontario, and he invented a special apparatus to overcome the disinclination of the powder to sink and come into full contact with the solution. Afterward the process was adopted at the O'Brien plant at Cobalt. Mr. Hamilton, in his paper, proceeds to describe the modifications introduced into the Merrill precipitation plant at Nipissing rendered necessary by the change from zinc to aluminium, and subsequently he gives figures relating to consumption, cost, and percentage of recovery. He finds that as a rule the extraction is well over 99%. The consumption of aluminium averages 0.02 lb. per ounce of silver. Judging by experience in other cyanide plants, he is of opinion that the consumption of zinc at Nipissing would have averaged 0.1 lb. per oz. of silver. On the basis of an ore containing 20 oz. silver per ton, the cost with aluminium would be as follows: 0.4 lb. aluminium at 38 cents per pound, 15.2 cents; caustic soda, 1½ lb. at 2¼ c. per lb., 3.3 cents; total 18.5 cents. With zinc: 2 lb. at 7 cents per lb., 14 cents. It would appear that the comparison was in favour of zinc, but on the other hand there is a direct recovery of 1.6 lb. of cya-

consist of four Pelton wheels, each coupled to a 1200-kw. alternator. Current will be transmitted at 6600 volts over 5 miles to the distributing station, where 8 transformers will be installed for reducing the current to 500 volts. During the past 20 years, 1½ million tons of timber from the adjoining forests has been consumed as fuel, and the yearly fuel bill is £50,000. The cost per horse-power-year is nearly £25. By means of the new installation the cost per horse-power-year is expected to be £8, including allowances for depreciation and interest on capital.

Secondary Enrichment of Silver Ores.—In the *Journal of Geology* for February, H. C. Cooke describes laboratory experiments undertaken with the ob-

action is much more powerful when ferric sulphate is present than when sulphuric acid acts alone. Except in the case of galena, the solvent action does not seem to be proportional to the concentration of the ferric sulphate present. This suggests that the sulphuric acid is really the active agent, and that the ferric sulphate acts principally as an agent for the removal from solution of hydrogen sulphide formed during the reaction. A mixture of sulphuric acid and ferric sulphate has a powerful solvent action on metallic silver, hence, in an orebody containing much pyrite, little native silver may be expected in the gossan; and conversely, if much native silver be found in the gossan, the orebody cannot have contained much pyrite, and



SECTION ACROSS WAIHI LODS.

ject of testing chemically the theories relating to the solution of primary silver ores by meteoric waters, and the subsequent precipitation at greater depth. The experiments were conducted at ordinary temperatures and pressures. We quote the conclusions based on his results.

Secondary sulphide enrichment of a primary silver deposit is brought about by reactions of silver or its sulphides with the sulphides of iron and their products of oxidation. When the iron sulphide present is pyrite, the silver sulphide is converted into sulphate wholly by the sulphuric acid and the ferric sulphate produced by the oxidation of the pyrite. When marcasite is present, as it rarely is in quantity, silver sulphide may be oxidized in part directly to silver sulphate by electrolytic action, and in part may be converted into sulphate by the action of the oxidation products of the marcasite. Sulphuric acid and ferric sulphate exert a powerful solvent action both on silver sulphide and on its companion sulphides, such as galena, chalcocite, orpiment, and stibnite. Of these, silver sulphide is the least affected. In all cases the

little secondary enrichment should be expected. The presence of ferric sulphate in the ground-waters increases the solubility of silver sulphate in them. This is probably due to the formation of a complex ion $AgSO_4$ by the silver, when ferric sulphate is present in solution.

The equilibrium in silver-bearing solutions between ferric, ferrous, and silver sulphates is such that the reduction of ferric solutions to the ferrous condition by any means will rapidly precipitate the silver in the metallic form. Precipitation of silver will not cease till all the ferric salt is reduced to the ferrous state. Hence the vertical extent of the zone of precipitation and its proximity to the surface will depend on the rapidity with which this reduction proceeds. If reduction be slow, native silver may thus be formed even at considerable depths. Native silver so precipitated will be comparatively stable in the presence of earth waters. Acids will not attack it in the absence of oxygen, since the solution pressure of hydrogen is greater than that of silver. Ferric sulphate cannot attack it so long as the ground-waters contain enough silver

sulphate to preserve equilibrium between the ferric and ferrous salts. Precipitated sulphur may convert it into sulphide.

The presence of sodium chloride in ground water does not increase the solubility of silver chloride therein, unless the amount of sodium chloride rises above 34.3 grammes per litre. On the contrary, it decreases the solubility. Terming the sodium chloride solution which contains the least amount of silver chloride the 'minimum solution,' then solutions which contain less sodium chloride than this minimum solution will precipitate silver chloride on taking up more sodium chloride; solutions with more sodium chloride than the minimum solution will precipitate silver chloride on dilution.

Silver chloride solutions containing sodium chloride in any concentration may form secondary silver sul-

The tailing from the tables can be treated by cyanide after being all slimed, as a large proportion of the gold is free in the quartz or in pyrite. The ore with which he experimented comes from Boulder county, Colorado. Here the silicious gangue is unusually hard, the figure approaching 7 in the scale of hardness. In comparison, the sylvanite has a hardness of from 1 to 1.5. The proportion of sylvanite present in the ore is usually much less than one per cent, and as it is finely disseminated, crushing to 40 or 60-mesh is necessary. The veins in this district, though numerous, are not extensive, and it would not be possible to treat more than 10 or 15 tons per day at each mill. The concentrate would be sold to refiners, and the tailing impounded for future treatment. The accompanying table gives the results of tests on 10-lb. lots, the figures for convenience being in grammes. It will be

RESULTS OF FLOTATION EXPERIMENTS ON TELLURIDE ORES.

	Weight Grammes	Ratio of Con- centration	Contents		Assay- Value Per Ton	Distribution of Contents		Recovery	
			Gold, Oz.	Silver, Oz.		Gold, %	Silver, %	Gold, %	Silver, %
(1) 40-mesh, Wilfley Table									
Wet feed	4536	—	2'49	2'21	\$51'13	—	—	—	—
Concentrate	2'36	19'22:1	22'37	20'73	461'84	46'95	42'82	—	—
(2) 40-mesh, Flotation and Wilfley Table									
Crude ore, dry	4536	—	30'38	12'77	415'26	—	—	—	—
Flotation concentrate	30	151'2:1	1748'80	863'20	36,213'92	57'92	41'71	—	—
Wilfley concentrate	207	21'9:1	115'20	88'80	2,357'28	25'80	31'73	—	—
Tailing	4177	—	3'06	2'22	62'53	13'83	16'01	—	—
Unaccounted	122	—	—	—	—	2'45	7'55	—	—
Combined concentrates	237	19'14:1	326'56	186'63	6,643'50	—	—	83'72	76'44
(3) 40-mesh, Flotation and Wilfley Table									
Crude ore, dry	4536	—	2'24	2'96	46'57	—	—	—	—
Flotation concentrate	16	283'5:1	332'60	270'80	6,814'48	52'37	32'27	—	—
Wilfley concentrate	158	28'7:1	17'70	21'70	367'02	27'52	25'53	—	—
Tailing	4009	—	0'59	0'80	12'28	23'28	23'91	—	—
Unaccounted	353	—	—	—	—	—	18'29	—	—
Combined concentrates	174	26'07:1	46'66	44'61	959'97	—	—	79'89	57'80
(4) 60-mesh, Flotation and Wilfley Table									
Crude ore, dry	4536	—	2'24	2'66	46'40	—	—	—	—
Flotation concentrate	25'5	177'8:1	248'00	187'80	5,072'68	62'26	39'70	—	—
Wilfley concentrate	268	16'9:1	7'04	13'46	148'88	18'57	29'91	—	—
Tailing	3857	—	0'46	0'54	9'52	17'49	17'30	—	—
Unaccounted	385'5	—	—	—	—	1'68	13'09	—	—
Combined concentrates	293'5	15'45:1	27'97	28'60	576'56	—	—	80'83	69'61

phide wherever they encounter hydrogen sulphide or any other substance that yields the sulphur ion even in minute quantity. Cerargyrite appears to be stable in presence of sulphuric acid and ferric sulphate. The action of dilute silver solutions on realgar, orpiment, and stibnite results in the substitution into these minerals of some silver; but the amounts so substituted were found to be so small that it appears doubtful whether the complex sulpho-salts of silver can be formed in this way.

Precipitated sulphur combines with precipitated silver at ordinary temperature and pressure to form silver sulphide. Silver sulphide is also formed by the direct reaction of hydrogen sulphide with silver-bearing solutions.

Concentrating Telluride Ores.—In the *Engineering and Mining Journal* for May 3, Henry E. Wood, of Denver, gives particulars of the application of concentration by flotation to the treatment of sylvanite and other telluride-gold ores found in Colorado. The tendency of the tellurides to form slime and float is well known to all who have tried water-concentration, and it is seldom that half the telluride is caught on a table. Mr Wood proposes to make use of surface tension only, without oil or acid. He grinds dry in a ball-mill to 40 or 60-mesh. Over 50% of the sylvanite floats on the water. The tailing is then sent to Wilfley tables, where a further 20 or 25% is recovered.

seen that in the first experiment without flotation, less than half the gold and silver was recovered, and that by floating first and treating on tables afterward, the recovery was 80% of the gold and 70% of the silver in the ore.

Coarse Crushing at South Crofty.—At the meeting of the Cornish Institute of Mining, Metallurgical and Mechanical Engineers, held on May 3, Josiah Paull, manager of South Crofty, read a paper on the concentration of tin ore, dealing particularly with the advantages of coarse crushing. He made some preliminary remarks on the apertures of Cornish punched screens and woven-wire screens.

For the purpose of comparison he showed some samples of battery-screens, consisting of woven wire and perforated metal sheets. Three of these samples in particular received his attention. No. 1 was a sample of what is known as No. 37 Cornish gauge perforated metal plate, and corresponded to what was used at South Crofty previous to the present control and was still used on two or three mines in the Camborne district. No. 2 was a 20-mesh woven wire screen such as had been used at South Crofty for two or three years. No. 3 was 14-mesh, of the same type as No. 2, and was generally used at South Crofty at the present time. He had been comparing the area of discharge in perforated screens with that of woven-wire screens. In the 20-mesh wire screen, such as was

originally used at South Crofty, there were 400 holes to the square inch. By the use of a round gauge, he found the size corresponding to a 35 Cornish would just fit the 20-mesh, the difference being that the 35 Cornish was round and the 20-mesh square, so that the area of the aperture of the woven mesh to that of the Cornish mesh was as 1 : 0.7854. There were 115 holes to the square inch in the Cornish grate compared with 400 in the woven wire. Thus the discharge area of the perforated screen was only 25% of the woven wire screen. The South Crofty 14-mesh screen corresponded with a 33 hole as regards round gauge, but there were 196 holes to the square inch in the woven wire mesh against 76 in the perforated screens, and the discharge area of the latter was only 30.5% of that of the woven mesh. It was obvious therefore that from the point of view of area of discharge woven wire screens had a great advantage over perforated ones.

During the 12 years he had been in Cornwall it had

This test showed a greater amount of -200 tin in the 20-mesh crushing than any other he had done, for some unknown reason. It might have been that the 10 stamps using the 20-mesh had too little water. He could not give the figures showing the proportion of wolfram in the + and -200 sizes of this particular test. He had however, other results of screened pulp samples which gave the wolfram assays, and three of these from 20, 14, and 10-mesh screens, given in Table II, were of interest, as they showed in each case a relatively higher percentage of wolfram in the -200 size than the tin does.

These tests gave proof that wolfram slimes much more than tin. This fact is proved in practice at South Crofty by the lower recovery. The reason why the wolfram did not make its presence felt more in the tin sold from South Crofty in the old days was because in crushing through perforated screens of small aperture the bulk of it was crushed to such a degree of fineness that it merely formed a colour in the water

TABLE I.

Mesh.	Grading Analysis.		Assay-Value per Ton Black Tin of 70% Metal Content.		Percentage of total Tin.	
	+200	-200	+200	-200	+200	-200
	%	%	lb.	lb.	%	%
20	49	51	16.4	34.6	31.3	68.7
14	63.3	36.7	21.0	31.8	53.4	46.6

TABLE II.

Mesh.	Grading Analysis.		Black Tin 70% Metal.		Wolfram.		Percentage of total.			
	+200	-200	+200	-200	+200	-200	Tin.		Wolfram.	
	%	%	lb.	lb.	lb.	lb.	+200	-200	+200	-200
20	50	50	27	47	3.9	12.8	36.4	63.6	23.3	76.7
14	59.6	40.4			11	22.5			41.9	58.1
10	64	36	24.3	34.3	9.28	17.15	55.5	44.5	49	51

TABLE III

Mesh.	Tons Crushed.	Assay-Value Black Tin to the ton. lb.	Tin Sold to the ton. lb.	% of Extraction wet tin sold.	Tin as sold
					metal assay. %
1910	20	60,916	29.5	23.16	68.28
1912	14	66,076	26.75	21.28	69.18
			or	21.56	68.28

been his misfortune or otherwise to be responsible for mines with complex ore. At the Clitters mine in the eastern part of the county, where he was manager for seven years, the ore contained tin, wolfram, and copper pyrite, while at South Crofty, where he had been for the last five years, the ore contained tin, wolfram, arsenical and copper pyrite. As far as copper was concerned, it was almost a negligible quantity, but wolfram and arsenic were important products. Last year the returns of these two products realized £21,040, and as the company's net profit was only £25,200, the value of these products was obvious. Wolfram was a friable mineral, and arsenical pyrite also, though to a less degree. Both these minerals made a much higher percentage of slime in crushing than tin. He started experimenting with coarser than 20-mesh screens more with the idea of improving the wolfram and arsenic recovery than for improving the tin extraction, but he found that it proved an advantage in the case of the tin also.

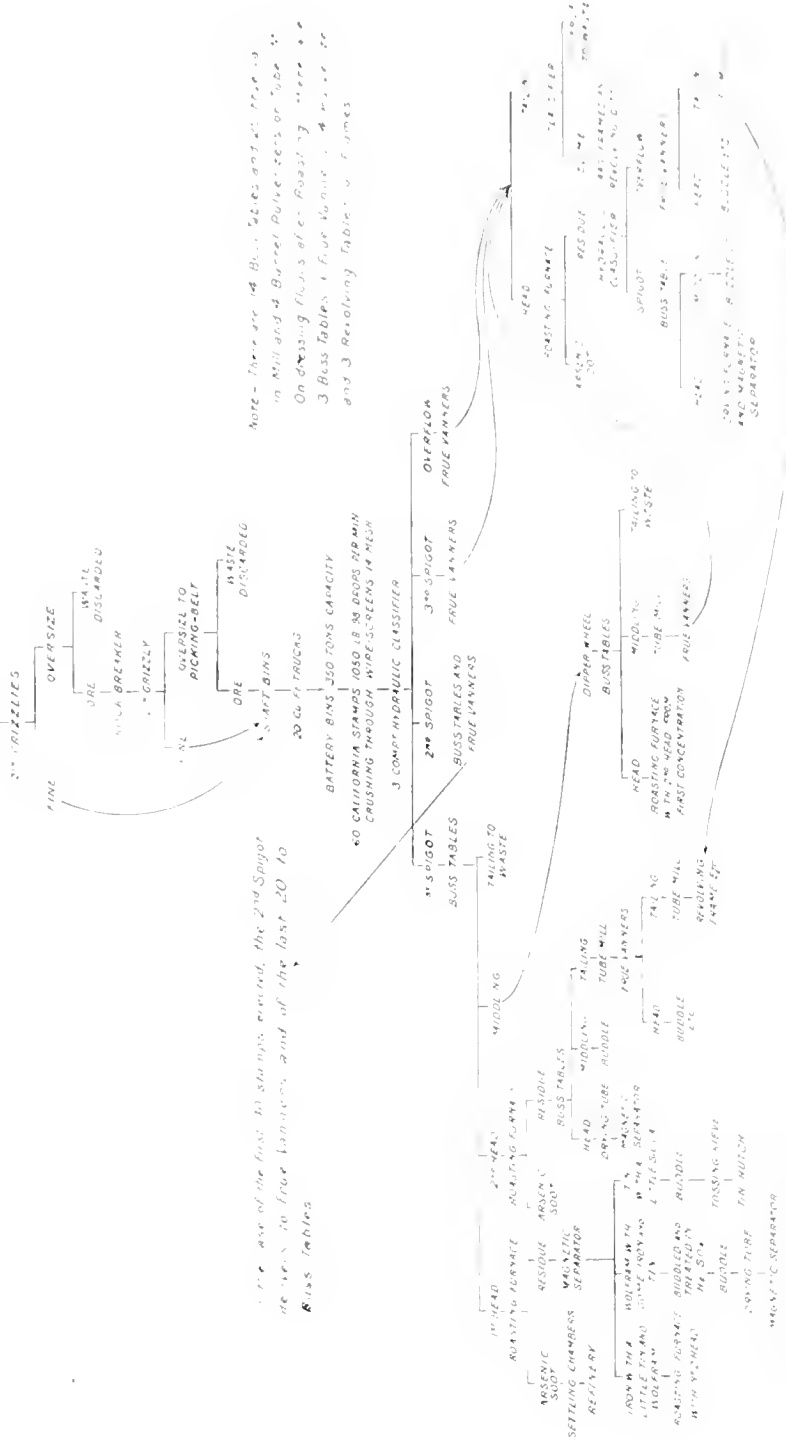
Mr. Paull proceeded to give comparative figures on the first tests he made in 1911. With 10 stamps crushing through 20-mesh screens and 10 through 14-mesh with the same ore, and under the same conditions as to speed, drop, &c., he got the given results in Table I.

and did not interfere in the dressing of the tin.

The above screening results prove that both tin and wolfram crush finer than the gangue in which they occur, and that wolfram crushes finer than tin. His object also was to prove that the use of comparatively coarse screens is conducive to a higher eventual recovery of both tin and wolfram, to a greater extent in the latter than the former.

At South Crofty the pulp from the stamp screens was regularly sampled throughout the 24 hours, such samples being taken to H. W. Hutchin to be chemically assayed. He took an equal weighed portion from each day's sample and mixed them together to form a weekly average. This weekly average sample was assayed for tin and wolfram, and Mr. Hutchin sent the result each week, expressed as so many pounds of black tin containing the percentage of metal, and wolfram containing the percentage of tungstic acid. In order to compare recovery results Mr. Paull gave Mr. Hutchin's weekly figures for two complete years, and their returns of tin and wolfram for the same period. The two years taken were 1910 and 1912. In the former year 20-mesh only was being used, and in 1912, 14-mesh and a small percentage of 10-mesh. It was desirable to go back to 1910, because in 1911 they were using all three sizes, and for the first few months

ORE FROM MINE.



NOTE - There are 14 Buss Tables and 14 Spigots in Mill and 4 Buss Tables and 4 Spigots in Dressing Flows after Roasting.

3 Buss Tables 1 First Flotation and 3 Revolving Tables 3 times

Use of the first 10 stamps covered the 2nd Spigot devices to four fractionners and the last 10 to Buss Tables

FLOW-SHEET OF SOUTH CROFTY.

W. M. W. S. 1914
 W. M. W. S. 1914
 W. M. W. S. 1914

20-mesh only. Sixty stamps were running in both years, and averaged practically the same number of hours. Apart from the difference in screens the conditions were the same. The results are given in Table III.

The increase in the wolfram recovery was 3.93%, and although he had no figures regarding the arsenic recovered, he was quite sure there was a considerable improvement in the recovery of this product as well. He was not going to give figures for the recovery of wolfram, for he was rather ashamed of them. In 1912 they treated lower-grade ore. In the case of tin, Mr. Hutchin's assays showed a decrease of 2.75 lb. to the ton, and the wolfram figures showed a decrease of 1.3 lb. Had the grade of ore been equal for the two years, the difference in the recovery would be still more in favour of the coarse mesh, as they all knew the lower the grade going to the mill the more difficult it was to keep up the percentage of extraction. Another point to be mentioned was the increase of tonnage crushed. By using the coarse screen they crushed 5160 tons more than in 1910, the only extra expense incurred being the installation of two re-grinding machines and the re-grinding of 12 tons per day, or 4380 tons per annum. The cost of grinding this extra quantity was 11½d. per ton, or £209 17s. 6d. for the year, against a saving of 3¾d. per ton in the crushing and dressing costs on 66,076 tons, the net saving per ton crushed as far as the battery and dressing floors was concerned being 2.99d. per ton of ore entering the battery.

Mr. Paull then gave an outline of the procedure at South Crofty. The ore was dumped on grizzlies with the bars set 2 in. apart. From the oversize as much granite and killas waste as possible was picked out and discarded, the remainder being fed into rock-breakers with the jaws set to crush down to a maximum of 2 in. At the main vertical shaft the rock-breaker delivered the crushed ore on to a second set of grizzly bars set at 1½ in. apart, the oversize from which fell on to an endless conveyor-belt from which was picked a further small percentage of waste. From the shaft bins the ore was taken to the mill bins. The pulp leaving the 14-mesh screens passed into upward-current classifiers, there being one 3-compartment classifier for each 10 stamps. The classifier was made on the mine and was simple, but quite as effective as most classifiers, some of which were costly to install and costly in maintenance. The sand and mineral from the spigot outlet of the first compartment went to Buss tables, and the second compartment in the case of the last 20 stamps erected also went on to Buss tables, but in the case of the first 40 stamps this product went to Frue vanners. This was because when the mill was first designed, 25-mesh screens were intended to be used, and were actually used for a short period. Should they ever extend the mill so as to require more Frue vanners he should take out those treating the second classifier product from the 40 stamps and replace them with tables. The third classifier delivered on Frue vanners throughout the mill, and any overflow from the classifiers was conveyed to a de-waterer, and the thickened pulp in the latter also sent to Frue vanners. They got four products from the Buss table. These products were termed first and second heads, middling, and tailing. The first head was practically clean mineral, consisting of about 4 tons per day, of from 5 to 6 cwt. of tin and wolfram, and 12 to 14 cwt. of pyrite, almost entirely arsenical, to the ton. The second head varied from 1 to 2 cwt. of tin and wolfram to the ton, and 6 to 8 cwt. of pyrite, chiefly arsenical, but with some copper as well; in the case of those tables treating the

ore from New Cook's section, blende and various other minerals were present. From 12 tables they got about 10 to 11 tons per day. The middling, consisting of a small portion of over-size which did not pass through a 40-mesh screen fixed at the end of the table for the second head to pass through, and also what was discharged over a distance of about 12 in. along the side of the table next to the head, was conveyed back to two dipper-wheels, each of which delivered on to Buss tables. The fourth product, or tailing, was sent away direct to the river as waste. Mr Harvey, who treated their waste on tribute, had not yet seen fit to do anything in the way of treating this sand-tailing, so that in spite of coarse crushing the recoverable loss was still in the fine product or slime. The middling product was, as stated, delivered by dipper-wheels on to two Buss tables, from which they got a small head, about 1½ tons per day; here they did not use screens, and the head from these two tables went with the seconds from the other 12 tables; about 20 tons from the two tables was elevated by a double dipper-wheel to 4 barrel grinders, and about 5 tons of final tailing was sent away with those from the other tables as waste. The re-ground middling was fed on to Frue vanners, the concentrate from these being mixed with that from the other vanners throughout the mill.

The tailing from the Buss tables was automatically sampled as discharged, and the average chemical assay of this was about 5½ lb. black tin of 70% metal. He tried some time ago an experiment with this tailing by passing it over a Record table to see if they could concentrate a small head that would pay to re-grind. They took 3 tons assaying 5 lb. black tin to the ton, chemical assay, and dividing the table into head, middling, and tailing, obtained the following results: the small head assayed 7½ lb. to the ton, the middling 5 lb., and the tailing 3 lb. He did not consider even the 7½ lb. head would pay to re-grind, at least it would not pay for the re-concentration before and after re-grinding and for re-grinding as well.

The Frue vanner treating the fine from the classifiers made, as usual, only two products, head and tailing; the head was sent to the furnace, and the tailing classified, the slime overflow from the classifier going to rag-frames.

As far as dressing after roasting was concerned, the three grades of concentrate as produced in the mill, namely, first and second Buss heads, and Frue vanner concentrate, were kept separate throughout. Three-quarters of the tin, wolfram, and arsenic as sold was the product of the Buss tables as against 25 Frue vanners required for the other quarter.

In conclusion, he gave it as his opinion that on all the mines fairly coarse crushing in the first instance could be adopted, provided a suitable concentrator was used, making more than two products. He was prepared to admit some of the tin was very fine indeed, but he also believed a fair quantity was moderately coarse. His idea was to keep that portion coarse as long as possible, and not to keep on pounding it in the stamps until the very fine tin was also free.

Zinc in the United States.—In the *Engineering and Mining Journal* for May 17, W. R. Ingalls presents his statistics for the production of zinc in the United States during 1912. The production by smelters was 348,638 tons, of which 7447 tons came from dross, scrap, and other re-worked material, and the remainder from ore. In addition, from 10,000 to 16,000 tons of zinc was placed on the market by firms who do not treat ore but only dross and scrap. During the year 1911, the production by smelters was 295,836 tons. The chief smelting district was Mis-

South Kansas, which produced 111,761 tons. Illinois was responsible for 91,902 tons, Oklahoma for 76,857 tons, the Eastern states for 86,278 tons, and Colorado 8860 tons. As regards fuel used, 40% of the production came from coal-fired furnaces, and the rest from furnaces using natural gas. These figures are unexpected, seeing that the current news had indicated a rapid fall in the use of natural gas. Two firms made zinc dust, the total being 492 tons, as compared with 284 tons in 1911. During the year, 2100 tons of zinc dust was imported. The statistics of the source of ore show that Missouri-Kansas produced 289,177 tons, Colorado 212,423 tons, Wisconsin 90,762 tons, Montana 34,044 tons with Nevada, Utah, New Mexico, and Idaho as subsidiary producers. Arkansas and Oklahoma have proved disappointments.

Copper-Selling Agencies in America. The *Mining and Scientific Press* for May 3 contains a table classifying the United States copper producers according to the selling agencies, and giving the production during 1912 in short tons. The disposal of copper production is a profitable business, competition for the business is keen, and changes are frequent.

UNITED METALS SELLING CO.

	Short Tons Year 1912
Anaconda and North Butte.....	147,000
Lake Mines (Copper Range).....	20,000
Arizona Copper Co.....	19,335
Utah Consolidated Mining Co.....	2,000
Greene-Canaana.....	24,173
Giroux.....	1,884
Pennsylvania Salt Mfg. Co.....	3,000
Imports.....	5,000
Total.....	224,392

AMERICAN SMELTING & REFINING CO.

Cerro de Pasco.....	24,000
Tacoma refinery and smelter product, Alaska, and miscellaneous.....	56,500
Utah Copper Co.....	47,600
Nevada Consolidated.....	31,750
Tennessee Copper Co.....	6,500
Ray Consolidated.....	17,700
Chino.....	14,350
Mason Valley.....	8,000
Ohio Copper.....	3,980
Total.....	209,880

PHILLIPS, DODGE & CO.

Copper Queen Smelter.....	61,638
Detroit Copper Co.....	12,488
Calumet & Arizona.....	27,600
Total.....	101,726

AMERICAN METAL CO.

Old Dominion Copper Co.....	13,785
Shannon Copper Co.....	8,250
Granby.....	11,315
Imports, Ducktown, & miscellaneous.....	28,000
Total.....	39,315
East Butte.....	7,382
Teziutlan Copper Co.....	5,000
Torreon smelter.....	2,500
Total.....	76,233

F. VOGELSTEIN & CO.

	Short Tons Year 1912
United States Smelting.....	11,250
Matte, smelter material, and imports.....	22,500
Orford Copper Co.....	7,500
United Verde Copper Co.....	16,500
Total.....	57,750

CALUMET & HECLA

Calumet & Hecla.....	32,745
Osceola.....	9,077
Allouez.....	2,813
Almeek.....	8,098
Superior.....	1,950
Tamarack.....	3,891
Isle Royale.....	3,984
Centennial.....	861
Victoria.....	600
Total.....	64,025

ADOLPH LEWISOHN & SONS

Miami Copper Co.....	16,407
Shattuck-Arizona (in 1913).....	7,500
Total.....	23,907

BEER, SONNHEIMER & CO.

British Columbia.....	5,500
Cuba Copper.....	2,500
Miscellaneous.....	2,000
Total.....	10,000

E. P. EARLE

South Utah mines and smelters.....	1,000
Mexican imports.....	1,500
Japan imports.....	2,000
South American imports.....	2,000
Total.....	6,500

DIRECT TO TRADE

Quincy Mining Co.....	10,125
Wolverine.....	4,560
Mohawk.....	5,997
Franklin.....	1,225
Mass.....	700

W. PARSONS TODD

Winona.....	1,100
Lake Copper.....	400
Total.....	1,500

Secondary Precipitation of Gold.—In the *Journal of Geology* for May, Albert D. Brokaw reviews the reactions tending to precipitate gold from circulating solutions. We quote his conclusions.

If gold is in solution in circulating waters, many substances may cause precipitation of the gold. The ferrous compounds, derived from the part oxidation of iron sulphides, are the most important, because they are formed comparatively readily from pyrite and other iron-bearing sulphides by the action of oxidizing waters. They are very often, if not always, present in mine waters, and they are effective precipitants for gold. The effect of the iron-bearing sulphides them-

selves cannot readily be separated from the action of ferrous salts, since in precipitating gold they may lead to the formation of ferrous sulphate, which, of course, may cause further precipitation of gold, if any is present. In most gold deposits sufficient pyrite or other iron-bearing sulphide is present in the primary ore to precipitate any gold that may be brought to the zone of sulphides. Less commonly siderite or iron-bearing calcite may be important. Siderite is attacked by acids more readily than pyrite, and consequently gives up ferrous salts more easily, and these, in solution, may cause the precipitation. In comparatively rare cases, when the gold is in a solution containing manganese salts, contact with the country-rock may neutralize the acids present and allow the manganese salt to release the gold. Rhodochrosite resembles siderite in its action, except for the fact that no precipitation of gold can occur if the solutions are strongly acid, while in the case of siderite acidity does not inhibit the reduction of gold chloride to metallic gold. The other reducing agents are of comparatively little importance, as they may be applied to only a very few unusual deposits. No attempt is made by Mr. Brokaw to explain the precipitation of gold from alkaline sulphide solutions, suggested by Lenher as a possible means for the transportation of gold, as such solutions are not formed in the alteration of gold deposits; their adequacy is confined to the transportation and primary deposition of gold, a subject beyond the scope of the present paper. We gave an abstract of Lenher's paper in our March issue.

CURRENT LITERATURE.

Shaft Sinking at Springs.—At the May meeting of the Institution of Mining and Metallurgy, a paper by B. D. Bushell was presented, describing shaft-sinking operations at the Springs mine, in the far east Rand.

Mine Sampling.—In the issue of the *South African Mining Journal* for April 12, A. S. Lejeune commences a series of articles on mine sampling and ore valuation, with special reference to the conditions on the Witwatersrand.

Compressed-Air Haulage.—The *Colliery Guardian* for May 23 contains a translation of a paper by T. Giller, read before the Society of German Engineers, describing the system of underground haulage by means of compressed-air locomotives.

Crown Mines.—The *Journal* of the South African Institution of Engineers for April contains a paper by R. C. Warriner, describing the underground work at the Crown mines, giving a great number of illustrative drawings.

Electric Hoisting at Cananea.—In the *Mining and Scientific Press* for May 10, H. L. Gooding and T. T. Read describe the electric-hoisting plant at the mines of the Cananea copper company.

Grading Analysis.—At the May meeting of the Institution of Mining and Metallurgy, a paper by H. Stadler was presented, entitled 'Grading Analyses by Elutriation.'

Cyanidation in India.—The March issue of the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by Hugh M. Leslie, recounting the introduction in the early days of the cyanide process at the Kolar gold mines, India.

Collecting 'Black Sand.'—The March issue of the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by J. M. Neill on the recovery of 'black sand,' that is to say, the pyrite containing gold with some iridium and similar metals that accumulates in present practice

only at the upper end of the amalgamating plates. He is of opinion that better extraction-results can be obtained if this black sand is caught in larger quantities on the plates and treated separately, instead of flowing to the cyanide plant, and he described a machine invented with the object of removing the air bubbles that ordinarily attach themselves to the particles and float them away.

Cyanidation at Grass Valley.—In the *Engineering and Mining Journal* for May 14, Herbert A. Megraw describes the cyanide practice at the North Star mine, Grass Valley, California.

The Trent Agitator.—In the *Mining and Scientific Press* for May 3, J. A. Carpenter discusses the advantages of the different types of agitators for the treatment of slime, and gives full details of the Trent agitator, as applied to continuous treatment at the West End plant, Tonopah, Nevada.

Silver Estimation.—In the *Engineering and Mining Journal* for May 3, G. H. Clevenger describes a rapid method for determining silver in cyanide solutions, based on Volhard's method. It has been developed with the particular object of providing the millman a ready means of estimating the silver to be precipitated from solution by zinc-dust, and therefore the amount of the latter actually required.

Smelter Contracts.—The *Mining and Scientific Press* for May 10, reprints a lecture given by Gelasio Caetani at Harvard University, discussing the basis of smelter contracts.

Zinc-Iron Compounds.—The *May Bulletin* of the American Institute of Mining Engineers contains a paper by G. S. Brooks on the formation of zinc ferrites in the process of zinc distilling.

Origin of Rand Ores.—The *Mining and Scientific Press* for May 10 contains a translation of the chapter in Richard Beck's new edition of the 'Nature of Ore Deposits,' devoted to a discussion of the origin of the auriferous conglomerates of the Rand.

West Rand.—On February 24, E. T. Mellor read a paper on the 'Structural Features of the Western Witwatersrand' before the Geological Society of South Africa.

Sulphide Ores of Copper.—The *May Bulletin* of the American Institute of Mining Engineers contains a lengthy paper by L. C. Graton and J. Murdoch, in which they describe their microscopical study of sulphide ores of copper. We shall give a précis of this paper in our next issue.

Prospectors and Geologists.—The April *Proceedings* of the Colorado Scientific Society contains George E. Collins' address on the occasion of his retirement from the presidency. He discussed the philosophy of following and discovering orebodies, and among other things, gave his views as to the relative value of the services of the local engineer or prospector and the visiting geologist. In his opinion the visitor did not fully appreciate the value of the man with local knowledge and experience.

Mica in India.—In a paper published in the *May Bulletin* of the American Institute of Mining Engineers, A. F. Dixon describes the mica industry of India.

Ostwald Nitric Acid Process.—The *Iron & Coal Trades Review* for May 23 contains a description of Ostwald's catalytic process for making nitric acid from ammonia, one of the processes to be used by the Nitrogen Products & Carbide Company.

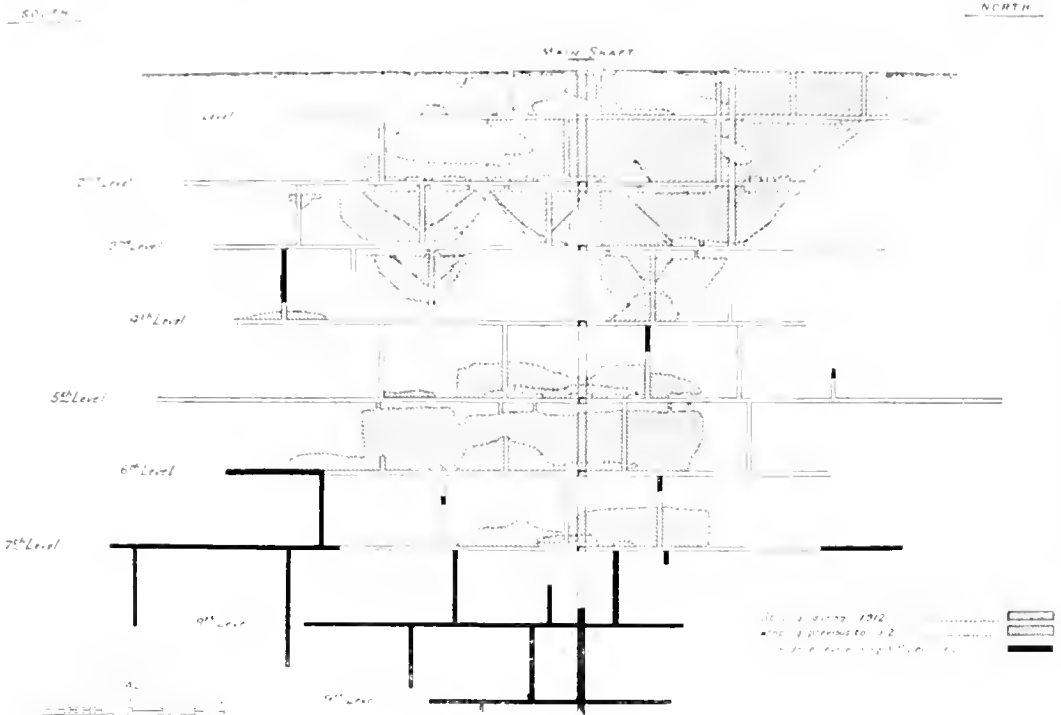
Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be obtained on application to The Mining Magazine.

COMPANY REPORTS

Lonely Reef. This company was formed in 1910, under Rhodesian laws, by the Lewis & Marks group, to acquire a group of partly developed gold mines, together with reduction plant, situated 35 miles north of Bulawayo. The orebody is persistent, and regular in content, and at the deepest point, 1124 ft. from the surface, the workings are still in the oxidized zone. The report for 1912 states that during the year two additional levels were driven, the 8th and 9th, at depths of 895 ft. and 1020 ft. On the former, 604 ft. out of 626 ft. driven, was in ore, and on the latter, 166 ft. out of 398 ft. In both cases the levels have not yet

with 634 tons of old slime. The yield was worth £160,179. As the facilities for sampling the leed are imperfect, the percentage of recovery is not determined exactly, but judging from the mine assays and the content left in the residue, the extraction is supposed to be from 90 to 95%. The net profit, after allowing for depreciation and taxes, was £81,860, and out of this £81,302 has been paid as dividend, being at the rate of 30%. Francis Drake is consulting engineer, and S. H. Bought manager at the mine.

Crown Mines. This company was formed in 1909 to consolidate the Crown Reef, Crown Deep, Robinson Deep, Langlaagte Deep, South Rand Gold, and other properties in the central Rand, and at the present



LONELY REEF, RHODESIA.

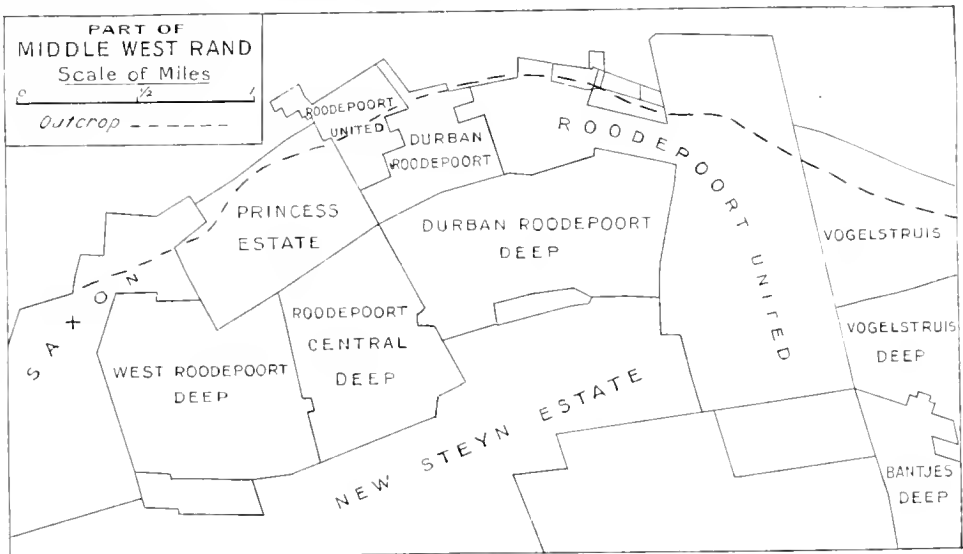
been extended to the full length of the orebody. The shaft is vertical to 1050 ft., and further sinking will be done on the incline, as the orebody pitches rapidly to the south. The winze below the 9th level is in rich ore, averaging more than 30 dwt. over a workable width. The ore reserve on December 31 was estimated at 124,142 tons, averaging 29 dwt. over a width of lode of 43 m. The ore is evenly distributed over the various levels, and it is notable that between the 7th and 9th levels the lode is wider and richer than in the upper levels. In stoping it is expected that the width of working will be 12 m. greater than the lode, so the estimate of milling ore is varied accordingly to 161,455 tons, averaging 22.27 dwt. In addition, there is 13,074 tons, averaging 24 dwt., broken in the stopes. The metallurgical plant has not been working well, partly because of the difficulty in getting suitable linings for the tube-mills. Though the ore is oxidized, it does not appear to be amenable to amalgamation, and it is being slimed and cyanided. During 1912, the amount of ore treated was 37,655 tons, together

time it constitutes one of the three largest consolidations on the Rand, the other two being the Randfontein and the East Rand Proprietary. It may in fact be called the premier gold mine of the world. The control is with Rand Mines, H. Stuart Martin is consulting engineer, and K. C. Warriner is manager. Mr. Warriner read an elaborate paper recently before the South African Institution of Engineers, detailing the re-organized underground arrangements for working the great property. During 1912, the total ore raised was 2,183,305 tons, of which about equal portions came from the Main Reef Leader and the South Reef, with a small amount from the Main Reef. At the sorting stations, 12% of waste was removed. The number of stamps employed was 660, and of tube-mills 22. The tonnage milled was 1,920,700, averaging 33s. 6d. per ton. The yield by amalgamation was 513,231 oz., and by cyanide 218,518 oz., a total of 731,749 oz., worth £3,071,216, being 32s. per ton. The working cost was £1,756,969, or 18s. 4d. per ton, leaving a profit of £1,314,247, or 13s. 5d. per ton.

Out of this, £238,727 was spent on capital account for shaft-equipment and other plant, and £49,644 appears as an extra charge for development over the estimated monthly rate: £126,998 went as profits tax, and £76,184 as expenses in connection with the issue of £1,000,000 debentures. The shareholders received £1,034,116, the dividend being at the rate of 110%. During the year, 23,544 ft. of development work was done, exposing 1,790,658 tons of ore. The reserve on December 31 stood at 10,607,671 tons, averaging 29s. 9d. per ton. Judging by claim area, the life of the property may be put at 40 years.

Princess Estate.—This company was formed in 1888 to acquire an outcrop property in the west Rand, to the east of the gap of broken ground separating the far west Rand from the main line of outcrop. The profits have been small and intermittent. In 1911 a consolidation was effected with the Roodepoort Central Deep and West Roodepoort Deep, and the metallurgical plant has been re-arranged, with the addition of tube-mills. The control is with the Goerz group,

Durban Roodepoort.—This company is not connected with any of the great houses of the Rand, and has been working an outcrop mine in the middle west Rand since 1888. It was here that the first discovery of gold on the Rand was made. The mine is now nearing its end. The more profitable South Reef is exhausted, and all that remains is 600,000 tons of Main Reef, averaging 20s. to 22s. per ton. This will keep the mill employed for about three years. There is an equal amount of ore in the mine that is not profitable under present circumstances. It is possible that some of this may eventually be proved to be worth extracting. The report for 1912 shows that 195,157 tons of ore was raised, and after the rejection of 14% waste, 165,920 tons was sent to the mill. The total extraction was 42,781 oz., worth £180,361. The net profit was £34,957, out of which £31,250 was distributed as dividend, being at the rate of 25%. The total distribution since the commencement has been £1,353,000, or 1100%. A tube-mill is being added, so as to grind finer, for it has been found that in the Main Reef ore



and P. von M. Anderson is manager. According to the report for 1912, 285,384 tons of ore was raised, and after the removal of 22% waste, 221,769 tons, averaging 6.36 dwt., was sent to the mill. The yield by amalgamation was 51,516 oz., and by cyanide 15,905 oz., a total of 67,422 oz., worth £285,221, or 6 dwt. per ton milled. In addition, 685 oz., worth £2851, was recovered from accumulated slime. The working cost was £286,221, a sum practically equal to the revenue. During the first four months of the year the labour supply was short, and the cost thereby increased unduly. Later in the year the conditions improved. As compared with 1911, the yield per ton was 3s. 11d. less and the cost 1s. 2d. less. Now that the plant has been fully re-organized and the labour situation improved, a further decrease in the cost may be expected during 1913. The percentage of recovery has been greatly raised by the re-modelling of the metallurgical plant, and is now returned at 95%. The ore reserve on December 31 was estimated at 637,000 tons, averaging 7 1/4 dwt. In addition there is 37,500 tons of 10-dwt. ore left as shaft pillars, and 310,000 tons of low-grade ore.

the association of the gold with the pyrite is more intimate. The treatment of this ore in the sand-plant has given poor results. It is expected that after the tube-mill is installed, the recovery will be improved. H. Ross Skinner is consulting engineer, and A. S. Milne manager.

Durban Roodepoort Deep.—This company belongs to the Rand Mines group, and owns a property in the middle west Rand. Milling started in 1898, but no dividend was paid until 1908. The ground is irregular, and the ore-shoots difficult to follow. In 1911 operations were hindered by a subsidence, and as the pumps were damaged the lower levels were flooded. The report for 1912 shows an improvement all round, and the prospects for the future are hopeful. The amount of ore raised was 357,270 tons, and after the rejection of 17% waste, 293,975 tons, averaging 31s. 6d. per ton, was sent to the mill, which contains 100 stamps and 3 tube-mills. The yield by amalgamation was 74,042 oz., and by cyanide 30,944 oz., a total of 104,986 oz., worth £439,699, or 29s. 11d. per ton. The working cost was £357,614, or 24s. 4d. per ton, leaving a profit of £82,084, or 5s. 7d. per ton. Out of

this, £27,071 was spent on capital account, £6734 was paid as profits tax, and payments under the Phylisus Act, etc., accounted for £1286. The shareholders received £44,000, being at the rate of 10%. This return is not high, seeing that the shares to provide working capital were issued at from £2 to £1. Percy Cazalet, the consulting engineer, and A. P. Kouillard, manager, report that the reserve on December 31 was 905,300 tons, averaging 28s. 2d. per ton, in addition to ore contained in the pillars. The latest developments are giving good results on both the South and Main Keels. A larger proportion of ore is now being taken from the Main Reef, and as this orebody, being wide, can be worked by machine-drills, the mine's position with regard to possible shortage of native labour is thereby improved. Water still causes anxiety, and additional pumps are being provided. When this new plant is at work and the modelling of the hoisting arrangements is completed, it is expected that the cost per ton will be substantially decreased.

Lancaster West.—This company owns a property in the far west Rand that has not been a success, and in fact operations were suspended in February owing to the high cost. The control is with the Goertz group. Milling started in 1899. In 1909 the adjoining Lancaster mine was absorbed. The two principal reefs worked are the Botha and the Battery. The report for 1912 states that 292,369 tons was raised, chiefly from the Battery reef, and after the removal of 15½% waste, 247,390 tons was sent to the mill, averaging 5.4 dwt. The yield by amalgamation and cyanide was 63,603 oz., worth £269,379, or 5.1 dwt., equal to 21s. 9d. per ton milled. The total working cost was £269,871, so that there was a loss of £492 for the year. The yield per ton was 11d. less than in 1911, and at the same time the cost has increased by 1s. 8d., due chiefly to scarcity and inefficiency of labour. The cost of renewals was considerable and will be so for some time. Also the profitable ore is scattered in small blocks over three separate reefs. Under these circumstances, there appeared to be no likelihood of any reduction in the cost of operations, so the mine was closed in February, as already mentioned. The ore reserve might have been increased and the position improved if work could have been re-started at No. 3 shaft on the Botha reef; this work however required the expenditure of £30,000, and at the present juncture this expenditure could not be recommended. The reserve is estimated at 335,500 tons, averaging 6 dwt. per ton.

Simmer Deep.—This company belongs to the Consolidated Gold Fields group and owns property in the eastern part of the central Rand on the dip of the Simmer & Jack. Its immediate neighbour on the west is the Jupiter, and the two companies own a joint mill of 300 stamps, the normal proportion being 180 for the Simmer Deep and 120 for the Jupiter. The outstanding feature of these two companies is the uniform low grade of the ore, and the difficulty of obtaining sufficient underground labour. The report of Simmer Deep for 1912 shows that 625,033 tons of ore was raised, and after the removal of 4.7% waste, 595,656 tons was sent to the mill. The average number of stamps employed was 126, and the average of the tube-mills was 3.3. The yield of gold was 124,289 oz. worth £321,957, equal to 17s. 0d. per ton. The working cost was £486,411, or 16s. 4d. per ton, leaving a working profit of £35,546, or 1s. 2d. per ton. As compared with 1911, the figures show a decrease of 1s. 2d. per ton in the yield, and a decrease of 3d. per ton in the cost. On the other hand, the amount of ore treated was 52,950 tons greater. The ore reserve

on December 31 was estimated at 1,430,693 tons, averaging 4.2 dwt. per ton, as compared with 1,469,719 tons averaging 4.4 dwt. a year ago. The company was formed in 1906 as an amalgamation of a number of deep level properties. The issued capital consists of 1,650,000 shares of £1 each, and there are £893,300 debentures. An examination of the accounts shows that the working profit of £35,546 is more than counterbalanced by the item of £51,842, debenture interest and expenses connected therewith. It is unnecessary to add that no dividend has ever been paid on the share capital.

Jupiter Gold. This company belongs to the Consolidated Gold Fields group, and was formed in 1896 to acquire property on the dip of what is now the Goldenhuis Deep. As mentioned in the preceding paragraph, the company owns a mill conjointly with the Simmer Deep, and the normal proportion of stamps is 120. Milling commenced in 1908, and the dividends so far paid have been 5% for 1909, and 5% for 1912. The capital is £1,014,000. The report for 1912 shows that 492,789 tons of ore was raised, and, together with 21,391 tons from the dumps, sent to the sorting station, where 7½% was removed as waste. The average number of stamps employed was 100, and tube-mills 6.3. The yield of gold was 116,241 oz. worth £487,676, or 20s. 5d. per ton. The working cost was £430,974, or 18s. 1d. per ton. After sundry items of income and expenditure were included, the working profit was returned at £63,632, or 2s. 8d. per ton. Out of this, £50,710 was distributed as dividend, being at the rate of 5%. The working cost per ton was 3s. less than in 1911, and the yield per ton was 2s. 4d. less. The amount of ore treated was 161,800 tons greater, so the increased profit per ton and the increased tonnage contributed to an increased profit for the year of £30,209. The scarcity of native labour has led to more machine-drills being used, and for 1912 the proportion of ore broken by machines was 92%. The ore reserve on December 31 was estimated at 1,270,000 tons, averaging 4.4 dwt. per ton, as compared with 1,232,511 tons averaging 5.1 dwt. the year before. The ore developed during the year was of poorer quality than the average, and the greater proportion of machine-drilling involving wider stopes accounts partly for the fall in average content of the reserve. It should be noted that the Jupiter and Simmer Deep companies now return their reserves in tons of ore in the mine, and not in milling tons allowing for the rejection of 10% waste. This alteration is due to the fact that the low grade of the ore makes it impossible to reject so large a proportion. The report refers to a proposed increase in the capacity of the mill from 45,000 to 60,000 tons per month, made possible by the recent improvement in the labour-supply. The number of stamps will not be increased, but coarser crushing will be adopted, with extra tube-mills.

May Consolidated.—This company, belonging to the Goertz group, owns one of the original outcrop mines in the middle east Rand, and the end is within sight. The report for the year 1912 shows that 15,390 tons less was mined than during the previous year, the yield per ton 4s. 4d. less, the working cost 1s. higher, and the total working profit £55,573 less. The reserve on December 31 was 133,000 tons, averaging 6.6 dwt. per ton. It is doubtful whether all this can be extracted at a profit, because, as there are so few working faces, the cost of mining will rapidly increase. The prospects of any profit after this month (June) are problematical. During 1912, 201,620 tons was raised, and after the removal of 16% waste, 169,080 tons, averaging 6.3 dwt., was sent to the mill, which was

kept fully employed all the time. The yield was 47,603 oz., worth £201,445, being a recovery of 5 0 dwt., equal to 23s. 10d. per ton. The working cost was £131,782, or 15s. 7d. per ton, leaving a profit of £69,663, or 8s. 3d. per ton. The profits tax absorbed £6904, and £72,187 was distributed among shareholders, being at the rate of 25%, part coming from the balance brought forward from the previous year.

Witwatersrand Deep.—This company was formed in 1895 to acquire a deep-level property in the middle east Rand, on the dip of Knights and Ginsberg. The control is with the Neumann group, S. C. Thomson is consulting engineer, and E. E. Hardach is manager. Milling started in 1902 with hired stamps, and was suspended in 1904. In the meantime the company erected its own plant, consisting of 245 stamps and 4 tube-mills. The first dividend was paid in 1906. During 1912, 498,021 tons was raised, and after the rejection of 9% waste, 451,000 tons was sent to the mill, averaging 6.94 dwt. per ton. By amalgamation 112,014 oz. was recovered, and by cyanide 38,591 oz., a total of 150,605 oz., worth £631,231, being 6.68 dwt. or 27s. 11d. per ton. The working cost was £426,224, or 18s. 10d. per ton, leaving a profit of £205,007, or 9s. 1d. per ton. Out of this profit, £26,485 was paid as profits tax, £32,893 was spent on capital account, and £137,500 was paid as dividend, being at the rate of 25%. During the year, the development work disclosed 414,410 tons of ore, averaging 7.2 dwt. per ton, and on December 31 the reserve was estimated at 1,492,257 tons, averaging 6.83 dwt. These results are gratifying, seeing that, in spite of the well known water difficulty, the reserve has been increased by 56,055 tons during the year. On the other hand, the tonnage milled was smaller by 49,330 tons, the cost per ton was 1s. 7d. greater, and the yield 1s. 3d. lower. It is expected that during 1913 the average content of the ore raised will be higher, and that, provided the labour supply is sufficient, a larger amount of ore will be raised, and at a lower cost.

Geduld Proprietary Mines.—This company belongs to the Goerz group, and was formed in 1899 to acquire gold-mining claims in the far east Rand. Two vertical shafts have been sunk to the 'reef,' No. 2 cutting it in 1905 at a depth of 1694 ft., and No. 3 in 1906 at 1839 ft. Milling commenced in November 1908 with 50 stamps and 2 tube-mills, but was suspended in the following February owing to unexpected flooding of the mine. After the provision of adequate pumping plant, operations were re-commenced at the beginning of 1910. No dividend has yet been paid. In the middle of 1912, 125,000 new shares were issued at par for the purpose of providing 10 more stamps and 4 tube-mills, and to push development work. The report for 1912 shows that 198,903 tons of ore was raised, and after the removal of 14% waste, 168,740 tons was sent to the mill, averaging 6.9 dwt. The yield by amalgamation and cyanide was 53,189 oz., worth £225,586, being a recovery of 6.3 dwt. per ton. The working cost was £138,276, to which is added £37,971 for development redemption, leaving a working profit of £49,338, or 5s. 10d. per ton. This is carried forward. The consulting engineer, W. McC. Cameron, and the manager, L. A. Womble, report that during the year the ore reserve was increased by 739,000 tons, and stood on December 31 at 1,475,000 tons, averaging 7 dwt. over 52 inches. The new plant is now ready to start. As will be seen from the relative number of stamps and tube-mills added, it is intended to make more slime. Four Brown agitators have been erected, and also a Butters filter plant.

Seoul Mining.—This company was formed in the United States in 1909 by the Collbran-Bestwick group, to operate the Suan gold mine in Korea, which had previously been worked unsuccessfully by an English syndicate. Milling was commenced with 20 stamps, and this number was doubled at the end of 1910. The capital is \$400,000, and dividends at the rate of 25, 50, and 50% were paid for the years 1910, 1911, and 1912 respectively. During 1912, 74,432 tons of ore was treated, assaying 88.53 in gold and 0.89% in copper. Gold bullion worth \$471,968 was recovered together with 736 tons of concentrate. The latter was shipped to European smelters. The gold content of the concentrate was valued at \$75,231, that of the copper at \$26,238, and that of the bismuth at \$19,024. The total value of the metals recovered was \$612,463, and the net profit was \$350,350. Out of this, \$180,000 was distributed as dividend, \$20,000 allowed for depreciation of plant, and the rest carried forward. The recovery of copper and bismuth is only 20%, owing to the friable nature of the sulphides. It is intended to install a flotation plant in place of the tables. A new development of considerable importance has occurred during the year in the discovery of another valuable gold-copper deposit at Tul Mi Chung, about 6 miles away, on the same granite-limestone contact. For the purpose of investigating the deposit, Hooper, Speak & Co. were asked to examine and report, and A. Harper Curtis was sent by them for this purpose. He formed the opinion that the ore reserve already disclosed warranted the construction of a mill with a capacity of 40,000 tons per year. He estimated the reserve at the Suan mine at 306,000 tons. It is intended to erect an electric power station at Pyeng Yang, 50 miles away, driven by steam or gas, and transmit current to the two mines. At present wood-fired steam-boilers are used, and fuel is becoming scarce. To provide for the development and plant at Tul Mi Chung and the erection of the power plant, additional shares are to be offered for subscription.

Ouro Preto Gold Mines of Brazil.—This company was formed by John Taylor & Sons in 1884 to acquire the Passagem gold mine, Minas Geraes, Brazil. Arthur J. Bensusan is superintendent. The report for the year 1912 shows that 68,486 tons of ore was raised and gold worth £106,884 extracted, being a yield of 31s. 2d. per ton. The working cost was £90,293, and royalty £3693; £8928 was allowed for depreciation, and £3663 was distributed among preference shareholders, being at the rate of 10%. The 100,000 ordinary shares received no dividend; in fact only 4s. per £1 ordinary share has so far been paid. Labour shortage continues to be one of the troubles at this mine, and efforts are being made to obtain workmen from Europe and elsewhere. The developments during the year have not given good results, and the ore reserve has fallen by 30,000 tons, standing on December 31 at approximately 2½ years supply. The lode is flat and has hitherto been worked by inclines. A main vertical shaft was started two years ago, calculated to cut the lode at 2000 ft. on the dip. Owing to the wetness of the strata, sinking has been delayed.

Basset Mines.—This company was formed in 1896 to acquire the Wheal Basset and the South Frances tin mines, situated three miles south of Redruth, Cornwall. The capital is £120,000, divided into two sets of preference shares, preferred-ordinary shares, and ordinary shares. So far the only dividends paid have amounted to 17½% on the preference shares. These are entitled to a cumulative dividend, and there is still owing £38,417 on this account. The report for 1912 shows that the grade of the ore mined has de-

creased, the yield being 254 lb. black tin per ton, as compared with 32 lb. in 1911. The ore raised was 42,520 tons, and in addition 4126 tons was taken from the dumps, making a total of 46,646 tons sent to the stamps. The yield was 50.2 tons black tin, which sold for £66,223. This compares with 586 tons, selling for £71,219, during 1911. The developments during the year have disclosed a fair amount of ore of higher content than that mined, but this ore is not yet ready for extraction. To the report is appended an analysis of the costs. From this it appears that the cost per ton has been reduced by 2s. 4d., being 26s. 9d. per ton for 1912. The receipts per ton were 28s. 5d., leaving a margin of profit of 1s. 8d. per ton. The actual profit was £5404, out of which £2522 has been

onebody on the No. 1 level, the available ore being estimated at 352,000 tons. At the Esperanza and Forzosa the reserve amounts to 529,000 tons. Only a small amount of ore is leached for copper content on the spot, and during 1912 the production of copper precipitate was 137 tons. The copper and sulphur content of the ore shipped is not given, as is usual with companies operating in this district. The working profit was £36,062, out of which £3332 was paid as interest on £66,357 debentures, £11,258 allocated for the redemption of debentures, and £17,500 distributed among shareholders, the dividend being at the rate of 5 per cent.

Lucky Tiger-Combination.—This is an American company, with headquarters at Kansas City, and it



NORTHERN SONORA, MEXICO

written off for depreciation, and £2971 distributed among the holders of preference shares. Francis Oats, lately chairman of the De Beers, is chairman of the Basset.

Esperanza Copper & Sulphur.—This company was formed in 1906 to acquire the Esperanza group of pyrite mines, in the south of Spain. The report for 1912 shows that at the Angostura mine 37,591 tons was raised, at the Esperanza and Forzosa 58,948 tons, and at the Nueva Esperanza 10,297 tons. The output at the Angostura was smaller by 10,000 tons than during 1911, having been curtailed because of the scarcity of shipping facilities from Huelva, due to the coal strike in England. At this mine the recent developments have greatly added to the reserve by the cutting of the

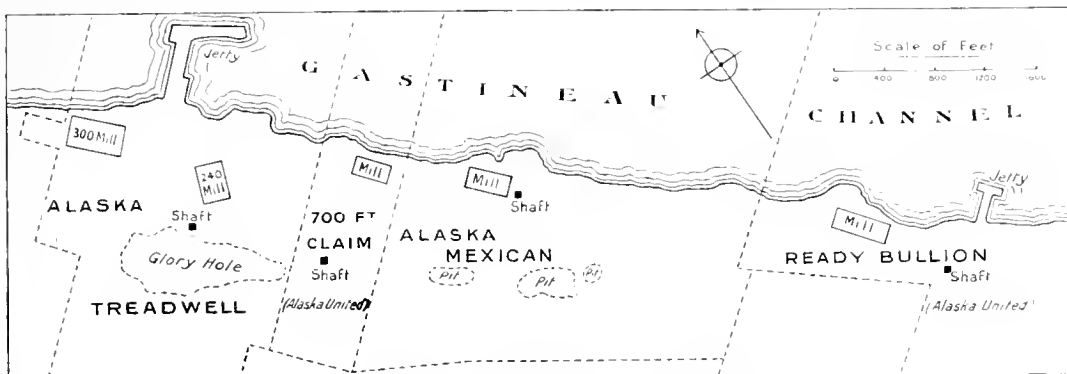
operates the El Tigre silver-gold mine, in Sonora, 65 miles south of Douglas, Arizona. James W. Malcolmson is consulting engineer, and L. R. Budrow is manager. The report for 1912 shows that 69,595 tons of ore was mined. Of this, 1151 tons, averaging 348 oz. silver and 1 oz. gold, was sold to the smelters, realizing \$288,194. 68,443 tons was sent to the concentrating plant, averaging 28 oz. silver and 2½ dwt. gold; 2625 tons of concentrate, averaging 331 oz. silver and 2 oz. gold was recovered and sold to the smelters, realizing \$671,429. The cyanide plant treated 76,808 tons of tailing, of which 14,614 tons came from the dump, the average content being 15½ oz. silver and 1¼ dwt. gold; the yield was 1,025,322 oz. silver and 4018 oz. gold. The total revenue was \$1,676,065, the working

cost \$964,414, and the profit \$711,681. Out of this, \$152,750 was devoted to the retirement of bonds and \$145,118 paid for extended plant. The shareholders received \$336,208. Since the commencement of dividends in 1908, the total distribution has been \$1,603,809. Developments continue to be satisfactory, and the reserve on December 31 was estimated at 152,411 tons, averaging 31.6 oz. silver and 2.2 dwt. gold. In addition, 66,000 tons of old tailing, averaging 13½ oz. silver and 1½ dwt. gold, is awaiting treatment.

Esperanza.—This company was formed in London in 1903 to acquire a majority of the shares in the Esperanza Mining Co., a New Jersey corporation operating the Esperanza gold mine at El Oro, Mexico, situated between the properties of the El Oro and Mexico Mines of El Oro companies. After paying handsome profits for some years the developments two years ago took an unsatisfactory turn, and the profits became greatly reduced. The report for the year 1912 shows that 124,888 dry short tons of ore

the manager's report, was \$256,014, United States currency, or \$8.51 per ton. The working cost was \$120,467, or \$4.00 per ton, leaving a working profit of \$135,547, or \$4.51 per ton. The accounts in English money show an income from sales of ore of £47,034, and Mexican expenses £21,687. The London expenses and allowance for depreciation totalled £1897, and £1450 was reserved for income tax. The shareholders received £16,500, being at the rate of 5%. A. C. Brinker, the manager, estimated the ore reserve on December 31 at 301,150 tons, an increase of 51,000 tons during the year.

Alaska Treadwell.—The report of this company for the year 1912 shows that 892,192 tons of ore, averaging \$2.67 per ton, was raised and sent to the mills. The yield of gold by amalgamation was worth \$1,159,401, being \$1.30 per ton; 17,397 tons of sulphide concentrate was treated by cyanide, and yielded gold worth \$1,046,487, or \$1.17 per ton of ore. The total production was \$2,205,888, or \$2.47 per ton. The 'profit' was \$1,169,720, or \$1.31 per ton. Ou



THE ALASKA TREADWELL GROUP OF MINES.

was milled, and 85,838 tons of tailing re-treated. The production of gold was worth \$1,361,308, and the working profit was \$286,919. The English company received £34,300 as dividend for 1912 from the American company, and £30,614 was distributed as dividend among English shareholders, being at the rate of 7½%. H. A. Titcomb, the consulting engineer, reports that the ore in the famous San Rafael vein is practically exhausted, and that developments in the San Carlos vein are being prosecuted, though the results are not particularly encouraging. He estimated the ore reserve on December 31 at 110,618 tons, which should yield a profit of \$320,600. In addition, there is 51,000 tons of old stope-fillings and other leavings, which will be extractable when the workings are cooled and ventilated.

Buena Tierra.—This company was formed by the Exploration Company in February 1912 to acquire a silver-lead property in the Santa Eulalia district of Chihuahua, Mexico. This mine had been a producer for some time under local ownership. The ore is found as a replacement in limestone, and the workings are still in the oxidized zone. The report now issued covers the period from the time of incorporation to December 31 last. Operations were hindered first by a strike of miners, and subsequently by the interruption of smelting at the Chihuahua smelter, where the ores are treated. The quantity of ore shipped was 30,085 tons averaging 8.65 oz. silver and 15.1% lead. The income from the sale of this ore, as returned in

of this, \$621,069 was written off for depreciation, and \$650,000 distributed as dividend. The sulphide concentrate is now treated by the joint plant of the Treadwell, Mexican, and United companies, instead of being sold to the Tacoma smelter. The recovery by the new plant is 97%. The report mentions that experiments are being made with the tailing from the mills; according to the above figures, the gold in the tailing is only 20 cents. It is intended ultimately to use the tailing for filling stopes. A year ago we recorded that a new scheme had been adopted for developing the mine at depth, in conjunction with the Alaska Mexican and the 700-Foot Claim belonging to the Alaska United. The central shaft of the 700-Foot Claim is to be used as the main shaft for the group, and it is to be sunk to 2100 ft. before cross-cutting to the orebody. From this level, stoping will be carried 150 ft. upward, and a solid pillar of 200 ft. will be left between the stopes and the 1750-ft. level. The latter level will be used as the base for all deeper working, and by this arrangement, the lower levels will practically constitute a separate mine. It will then be possible to extract ore from pillars between the 1750-ft. level and the surface without fear of loss of the lower levels by caving. The ore reserve on December 31 was estimated at 6,977,258 tons, of which 1,275,262 tons is already broken in the stopes.

Alaska Mexican.—During the year 1912, 233,299 tons of ore were raised and milled, gold worth \$307,951 was extracted by amalgamation, and \$371,169 by the

cyanidation of 1956 tons of concentrate, being a total of \$679,120, or \$2.91 per ton. The working profit was \$310,353, or \$1.33 per ton. Out of this \$225,000 was distributed as dividend, and \$100,759 was written off for depreciation. The ore reserve on December 31 was 1,040,361 tons. Further particulars are given in the paragraph on the Alaska Treadwell.

Alaska United.—This company owns two mines and mills. One mine is the 700-Foot Claim situated between the Alaska Treadwell and the Alaska Mexican, and the other the Ready Bullion, farther to the east. As mentioned already, the deep levels of the Treadwell, Mexican, and 700-Foot Claim are to be developed from the shaft of the last-named. During the year 1912, 216,454 tons of ore was extracted from the Ready Bullion, yielding \$317,970 by amalgamation, and \$500,188 from the cyanidation of 6128 tons of concentrate, making a total extraction of \$618,158, or \$2.85 per ton. The working profit was \$293,260, or \$1.35 per ton. At the 700-Foot Claim, 234,339 tons was raised, yielding gold worth \$282,180 by amalgamation, and \$294,952 by the cyanidation of 4704 tons of concentrate, being a total of \$577,132, or \$2.46 per ton. The working profit was \$252,367, or \$1.07 per ton. From the total profit of the two mines, the sum of \$222,522 was written off for depreciation, and \$324,360 was distributed as dividend.

Anaconda Copper.—The report for 1912 of this company, owning the group of copper mines at Butte, Montana, is brief. It states that during the year the Washoe plant treated 3,880,203 dry tons of ore and other cupriferous material, and the Great Falls plant 1,189,039 tons. Of this total, 4,486,872 tons was ore from the company's mines, 581,031 tons purchased ore, and 1337 tons precipitates and cleanings from the old works. The total production of metals was 147,237 short tons copper, 11,014,736 oz. silver, and 61,314 oz. gold. The income from the sale of the metals was \$51,723,031, and the net profit was \$15,856,334, out of which \$10,831,250 was distributed as dividend, being at the rate of 10%. The development done during the year amounted to 34 miles. Twenty-two shafts are used for hoisting.

Waihi Grand Junction.—This company, owning the gold mine in New Zealand adjacent to the Waihi, suffered from the labour strike during 1912, for milling was suspended on May 13 and has only just been resumed. The mine filled with water, and though the strike ended in November, it was not possible to recommence mining until February. During the time the mill was running, 41,712 tons of ore was treated, yielding bullion worth £77,582, being a yield of 40s. 10d. per ton, of which 36s. 8d. was in gold and 4s. 2d. in silver. The tailing assayed 5s. 2d. in gold and silver. The yield per ton was 8s. 2d. higher than in 1911. The cost per ton during the time the mill was running was slightly lower, but the average cost during the year was increased by the standing charges during the period of idleness. The profit for the year was £5730, and this was carried forward. The development work yielded highly satisfactory results, for it proved the Empire Footwall Branch to be a persistent body of high-grade ore. The ore reserve on December 31 was estimated at 187,750 tons.

Golden Horse-Shoe Estates.—After enjoying continuous prosperity for a dozen years, this company, owning a leading gold producer at Kalgoorlie, West Australia, suffered a relapse three years ago, when it was found that the ore reserve was not of as high an assay-value as originally estimated. Since then the developments have not disclosed any further important supplies of high-grade ore. During the prosper-

ous dozen years dividends totalling £3,000,000 were distributed. In 1910 shareholders received only £75,000, and nothing during 1911 and 1912. The report for 1912 shows that 280,868 long tons of ore was treated, yielding gold worth £387,840. The balance of profit, after payment of £6000 interest on debentures and allowing £45,596 for development, was £10,479. Out of this, £6200 has been allocated to the redemption of debentures. J. W. Sutherland, the manager, reports that the ore reserve on December 31 was 714,141 tons averaging 8 dwt., as compared with 804,269 tons averaging 8.8 dwt. a year before. The fall is largely due to the scarcity of skilled miners, and it happens also that this scarcity has made it impossible to prepare some of the better quality ore for stopping, thus accounting for the decrease in the yield during 1912. Mr. Sutherland is of opinion that when development is brought up to requirements the mine will once more provide dividends.

British Broken Hill. The report of this company for the half-year ended December 31 shows that 103,710 tons of ore was treated, averaging 13.2% lead, 11.7% zinc, and 7.3 oz. silver, yielding 15,003 tons of lead concentrate averaging 63% lead, 6.6% zinc, and 24 oz. silver; 49,238 tons of zinc tailing was treated in the Elmore plant, averaging 3.9% lead, 14% zinc, and 3.8 oz. silver, yielding 13,386 tons of zinc concentrate, averaging 11.7% lead, 40.2% zinc, and 11.4 oz. silver. In addition, 23,054 tons of slime was produced, and sold to the Junction North company. The consulting engineer, C. G. Klug, is introducing improvements in concentration practice. The lead plant is being extended so as to treat more ore and to give a better product, and the Elmore plant has been dismantled in favour of the Minerals Separation process. The latter plant will be ready in October, and in the meantime the zinc tailing is being sold to the Zinc Corporation. It will be remembered that the British Broken Hill has not been so successful as others in the district, and that on two occasions the mine was closed owing to the low price of metals. Work was recommenced in 1910 and profits made. A year ago a new orebody was discovered, and much controversy was caused as to the average content. The engineers now report that much more development will have to be done before the actual value of the deposit can be gauged. An issue of 60,000 new shares was made last autumn at £2. 10s. each to provide the working capital for this development work. As regards the accounts for the past half-year, £190,561 was received from the sale of lead and zinc concentrates and slime, and the balance of profit was £61,836, out of which £46,374 was distributed as dividend, being at the rate of 15 per cent.

Nipissing.—This company was registered in the United States in 1906, for the purpose of holding the share capital of a Canadian company of similar name, formed in 1904 to develop property at Cobalt, Ontario. This and the La Rose were the pioneers of the district, and have continued to be the largest producers. The Nipissing is also notable for having adopted a cyanidation-amalgamation process for treating the ore on the spot instead of shipping the ore and concentrate to smelters. During the year 1912, 121 tons of high-grade ore, 1414 tons of low-grade ore, and 181 tons of concentrate were shipped to smelters, containing 809,611 oz. silver. The high-grade cyanidation-amalgamation plant treated 1752 tons, and extracted 4,258,641 oz. The net income from the sale of ore and bullion was \$2,827,299, and of this, \$2,081,710 was profit. Dividends absorbing \$1,800,000 were paid. The total production to date has been 27,741,248

oz. silver, and the dividends \$10,168,297. Prospecting and development have continued to disclose large amounts of ore; and the reserve on December 31 was estimated at 3304 tons of high-grade ore, averaging 1650 oz. per ton, and 185,173 tons of low-grade ore, averaging 22 oz. per ton. It is noteworthy that surface prospecting is done by the aid of hydraulic stripping instead of by trenching. Since the close of the year the cyanide plant for treating the low-grade ore has been completed and the cost paid out of revenue, so in future the whole of the ore will be

outlook became much less hopeful. Nevertheless some ore has been found in the diabase, and prospecting laterally has revealed a few additional veins in the Keewatin. The report for 1912 shows that 48,003 tons was raised, of which 15,784 tons was rejected as waste, 114 tons shipped to smelters, and 31,180 tons sent to the concentrating plant. The 114 tons of high-grade ore contained 497,875 oz. silver. The concentrator treated 40,056 tons, averaging 22.6 oz. per ton, and produced 890 tons of concentrate containing 744,370 oz., or 836 oz. per ton. The percentage of recovery



COBALT, ONTARIO.

treated on the spot. The low-grade plant contains 40 stamps of 1500 lb. each, and four tube-mills measuring 20 by 6 ft. Aluminium dust is used for precipitating the dissolved silver. This method of treating the silver ores of Cobalt was devised by G. H. Clevenger and Charles Butters and the adoption of aluminium is due to E. M. Hamilton. Particulars of the aluminium reaction are given in 'Precis of Technology.'

Temiskaming.—This company was formed in 1907 to acquire property in the Cobalt silver district of Ontario, situated to the southeast of the earlier-discovered mines. Burr E. Cartwright is chairman, and Norman R. Fisher is manager. From 1907 to the end of 1912, the total output of silver was 6,433,636 oz., and \$1,309,155 has been distributed in dividends. A year ago the workings left the Keewatin formation and entered the diabase, with the consequence that the

was 82%. It is interesting to note that the smelters paid for 16,037 lb. copper, the first instance of any credit being given for this metal in Cobalt ores. The accounts for the year show receipts \$762,653, and a net profit of \$413,615, out of which \$300,000 has been paid as dividend. On it being ascertained a year ago that the resources of the property were limited, a controlling interest in the North Dome mine, at South Porcupine, was acquired. The development of this property has been greatly hindered by labour troubles.

Tronoh.—The report of this company, owning the premier tin mine of the Malay States, shows that 496,495 cubic yards of ground was treated, yielding 2776 tons of concentrate, realizing £349,334. The yield per cubic yard was 12½ lb. These figures were not so high as during the year before, when 3856 tons of concentrate was recovered and sold for £438,069, the

yield per yard being 21 lb. The 1911 figures were however abnormally high, on account of the deputy manager picking the best ground during H. D. Griffiths' absence. The accounts show a profit of £157,798, out of which £120,000 was distributed as dividend, being at the rate of 75%, and £30,218 was written off the property account. Mr. Griffiths has recommended the adoption of bucket dredging for a portion of the ground, and A. C. Perkins has confirmed his view. This ground is too irregular in content to be suitable for the present methods used in the richer parts of the company's property.

Lahat Mines.—This company is nearly allied to the Tronoh, and was formed in 1906 to acquire tin-bearing ground at Lahat, in the Kinta district of Perak, Federated Malay States. The position of the property is indicated in the map on page 375 of our May issue. The capital is £120,000, and dividends at the rate of 2½, 10, 15, and 17½ per cent have been paid for the years 1909 to 1912 respectively. The report for 1912 shows that 270,927 cubic yards of karang was treated, and 441 tons of cassiterite concentrate recovered. This sold for £54,928, the price received averaging £127 per ton. The ground let on tribute brought an income of £4787. The mining cost was £31,642, and after the payment of London expenses and income tax, and allowing for depreciation, a balance of £23,687 remained. Out of this, £23,500 was distributed as dividend, being at the rate of 17½%. Additional property has been acquired connecting the old property with the granite hills to the west. O. S. Daburn is the manager.

Tekka.—This company belongs to the Wickett group, with headquarters in Kedruth, and was formed in 1907 to acquire a property in the Kinta district of Perak, Federated Malay States, on the other side of the Kinta valley to the Tronoh and Lahat. In 1910 an additional property was purchased, in the Taiping district, north of Kinta. Dividends were first paid in 1909, and the profits have steadily grown. The Tekka ground is hydraulicked, and a suction-pump dredge is used at present at the Taiping property. The report for the year ended January 31 last shows that at Tekka 593,493 cu. yd. was treated, for a yield of 435 tons. The recovery was 1.64 lb. black tin per cu. yd. At Taiping, 296,350 cu. yd. was treated, for a yield of 127 tons, or 0.93 lb. per cu. yd.; the developments point to bucket-dredging being the best method of working the deposit, and an alteration is contemplated. The total profit for the year was £35,625, out of which £30,000 has been distributed as dividend, being at the rate of 37½ per cent. Osborne & Chappel are the managers.

Spassky Copper Mine.—This company was formed in 1904 to acquire the Yuspensky copper mine, the Spassky smelting works, and the Karagandy coal mine, in the Akmolinsk district of Siberia. We have many times previously given the earlier history of the enterprise. In 1911 a controlling interest in the Atbasar company, owning another copper property to the southwest, was purchased. Last month the whole of the Atbasar property was absorbed by the Spassky company, on terms detailed in our May issue. The report of the Spassky for the year ended September 30, shows that 28,315 tons of ore was raised, averaging 20% copper. The smelter treated 23,759 tons, averaging 18½% copper, for a recovery of 3998 tons of metal. As regards development, the Annensky shaft has been sunk to 560 ft., and a level opened at that point with gratifying results. Further sinking is in progress. At the coal mine, 64,757 tons was raised, chiefly for use at the smelter. The income from the

sale of copper was £306,284, the average price being £91 per ton. The net profit was £162,735, out of which £148,832 has been paid as dividend, being at the rate of 25 per cent.

TRADE NOTES

Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.

The Hardinge Conical Mill Co. report having received an order for eight additional pebble-mills from the Braden Copper Co., bringing the total to twenty-four. An order has also been received from the Vieille Montagne Zinc Co. for an 8 ft. pebble-mill, for their zinc-lead mine at Nenthead, Northumberland.

'**Modern Methods of Cutting Coal**' is a 48-page bulletin issued by the London office of the Sullivan Machinery Co. While we have comparatively few colliery engineers on our mailing list, the metal miner will be interested in noting the progress that has been made in mechanical appliances underground in coal mines. While the machines used for coal cannot be used on the harder gangue of metal mines, the principle may suggest an application. Albert Frost & Sons, of Rugby, printers of this magazine, are responsible for the excellent typographical work, while the designs were made by our catalogue department.

The British Engineering Company of Siberia is the title of a new company that it is proposed to incorporate in England to do general machinery business in Siberia. The promoter, Arthur G. Marshall, has prepared an elaborate and carefully written memorandum, dealing in great detail with the urgent necessity for united action among British manufacturers to recover the lost trade of this growing but commercially isolated country. This 73-page memorandum contains interesting and instructive tabulated information concerning the imports into Siberia, with comparative tables showing country of origin. It is proposed to form this company by combining, for Siberian trade only, a limited number of representative British firms manufacturing non-competitive machinery. The registered offices are to be in London. The working units are to consist of engineer-salesmen, each one representing and specializing in a particular machine. It is proposed to secure the services of Russians for this work. These engineer-salesmen are to be under a chief engineer or manager. The Siberian offices will be at Vladivostok and Omsk, and as business grows branches will be established in the less frequented centres. Catalogues, bulletins, and announcements will be translated into Russian.

We are not competent to question the accuracy of the forecast as to the expenditure involved in such a complete scheme for representation. It strikes us as liberal. But the entire scheme appears most commendable, and, if we are correct in assuming that British manufacturers are earnest in their desire to increase their foreign trade, Mr. Marshall will have difficulty in selecting from the large number of applicants for representation. We do not desire to discourage the efforts of the promoter, but it is well known that British manufacturing firms have never shown the least inclination for combined effort. This well-settled policy must be overcome.

Mr. Hodgson, the British Consul at Vladivostok, in his report on the trade of Vladivostok for the year 1910, deplors the lack of British enterprise in the Far East. Mr. Marshall's scheme is opportune.

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DRESSING MACHINERY.

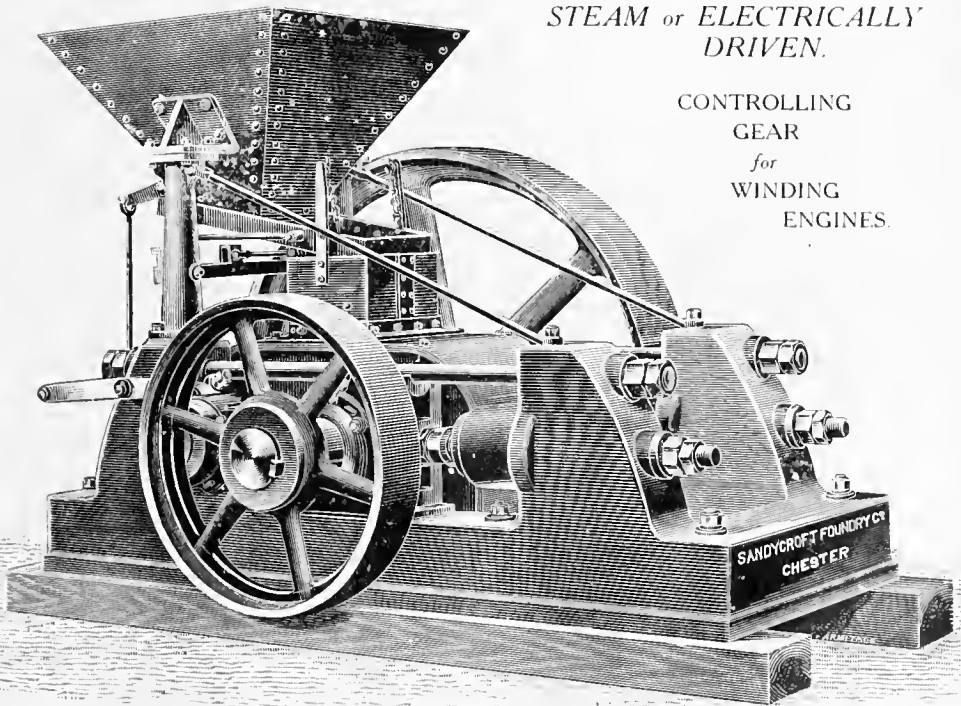
ROLLS, JIGS,
VANNERS, Etc.

BREAKER PLANTS.
STAMP MILLS.

TUBE MILLS.

WINDING ENGINES
*STEAM or ELECTRICALLY
DRIVEN.*

CONTROLLING
GEAR
for
WINDING
ENGINES.



HIGH-SPEED CRUSHER ROLLS.

SPASSKY COPPER MINE, LIMITED

THE eighth annual general meeting of the Spassky Copper Mine, Limited was held on May 14, at the Liverpool Street Hotel, Bishopsgate, E.C., Mr. Arthur Fell, M.F. (chairman of the company), presiding.

The Chairman said that the period covered by the report and accounts had been one of considerable activity and expansion, and that in every department results showed a great advance upon those of any previous year. The net profit in Siberia showed a marked increase over the previous year, and the figure of £173,000 was arrived at, after allowing for a sum of about £43,000, payable to the Russian Government, by way of tax on profits earned. An interim dividend of 2s. per share was paid in July last, and the board now proposed to pay a final dividend of 3s. per share, making, in all, 5s. for the year. The production for the whole of last year was 3998 tons, and the monthly output had since been increased. For the first six months of the current year the production had been 2621 tons, or at the rate of over 5000 tons of copper a year. They had reduced costs of production per ton to the very low figure of £28.9s. 4d., or a reduction of over £9 on the previous year. Coming now to the Yuspenskyy mine, when he addressed them last year he informed them that they were about to sink the main shaft to the next level—that is, 70 ft. below the 490 ft. floor. At this level, which was 560 ft. from the surface, the orebody had been driven on east and west of the shaft, and excellent results had been obtained. In the level above they found the best results west of the main shaft, but at the 560 ft. level, not only had the high values found above been maintained west of the shaft, but very substantial values had also been found to the east. It was now proposed to sink the main shaft another 70 ft. to the 630 ft. level. According to Mr. Woolmer's report last year, there had been developed to the 70 sagine level some three or four years' supply. The results met with at the 80 sagine level considerably added to the estimates then given, but it was impossible to give definite figures of the increased tonnage available until further driving and cross-cutting had been done. At the last general meeting he referred to the question of the lower-grade ore, and stated that they proposed to study the question of its concentration. They had been conducting experiments to that end, but during the last twelve months they had devoted their energies more particularly to opening up the mine at the lower levels, and, having regard to the fact that they still continued to meet with very rich ore, of which they had several years' supply, the question of concentration would only press if railway communication made it desirable to increase the plant substantially. With regard to the Karagandy Coal Mine, the output for last year constituted a record, in consequence of the increased production of copper. He had upon several occasions referred to the potential value of the colliery, and each year the time was getting nearer when they would be in railway communication with the main Siberian system. He had only again to remind them that this colliery should eventually prove to be a very valuable asset. Mr. Woolmer had estimated that the Karagandy contained about 400,000,000 tons of coal. They knew that some of the largest known ironstone

deposits existed in Western Siberia, and when the district was opened up by railways the conjunction of coal and iron would assuredly be attended by its inevitable consequence, and Karagandy should become an important industrial centre. As foreshadowed last year, they had taken an interest in a company formed in Moscow for electrolysing copper. With them were associated the most important firms in the Russian copper trade. The capital of the company was 1,200,000 roubles, all of which was subscribed in cash. Their share, with the Atbasar Company, was one-quarter of the whole. The refinery was expected to be completed this year. They had suffered a great loss during the last few months by the death of Mr. H. A. Scott. Mr. Scott had been a director of the company since its inception. He had given to its service liberally of his time and energy, and the directors had to deplore the loss of a valued friend, as well as a capable colleague, whose interest in the company never flagged or weakened when its fortunes seemed less prosperous than was now happily the case. Their thanks were due to Mr. Woolmer and the staff in Russia and Siberia, and they would be asked to pass a special resolution of thanks to them. He moved that the report and accounts be received and adopted.

Mr. Ernest Carnot (vice-chairman) seconded the resolution.

The Chairman then proceeded with the second part of the meeting, and moved the resolutions for the amalgamation of the Spassky and Atbasar companies. The Spassky Company at present owned a two-fifths interest in the capital of the Atbasar Company, which was £500,000, and it was now proposed that the Spassky should take over the whole undertaking of the Atbasar Company. During the two years since the two-thirds interest was acquired it had become evident that the Atbasar Company owned copper deposits of very great importance. The ore proved up to June 30, 1912, amounted to 517,909 tons, averaging 10.25% of metallic copper, of an approximate net profit value of £1,400,000. This statement only applied to the ore proved up to nearly twelve months ago on a small portion of the claims originally acquired from the Russian vendors; since that date developments had continued to be highly satisfactory. The interesting feature of the Atbasar Company was not so much its present developments as its prospective value. They had no doubt that further large quantities of ore could be rapidly and cheaply opened up, and they had good reason to hope that the next year or two would demonstrate the property to contain one of the most important copper deposits in the Russian Empire. As regards the terms of purchase of the Atbasar, they would first create 150,000 new Spassky shares, with which to acquire the outstanding Atbasar shares, which equalled three-fifths of the whole. This would bring their issued capital up to a little short of £750,000. They would then issue 250,000 shares to shareholders at par, equal to one share for every three Spassky shares held. This would bring up the capital to £1,000,000. So far as they could see, the new issue would provide all the capital required for the Atbasar and leave a good margin over.

Mr. Ernest Carnot seconded the resolutions, which were unanimously approved.

TANGANYIKA CONCESSIONS, LTD.

THE ordinary general meeting of the shareholders of Tanganyika Concessions, Ltd., was held on May 30, at Winchester House, Old Broad Street, E.C. Mr. Tyndale White (chairman of the company) presiding.

The Chairman having moved and Mr. Sheffield Neave seconded the resolution for the adoption of the report and accounts,

Mr. Robert Williams proceeded to review the progress of the enterprise. After giving details of the railway progress he turned to the copper deposits and the smelting operations. With regard to the smelting and other operations in Katanga of the Union Minière Company, in which they were so largely interested, the last annual meeting of that company was ably addressed by Mr. Jean Jadot, who laid before the shareholders a statement as to the progress that had been made in the treatment of the ores from the Katanga mines. In discussing some of the points of Mr. Jadot's speech, Mr. Williams said he considered the matter of most direct importance was that the consumption of coke per ton of copper produced in smelting operations was reduced from 3.44 to 2.65 tons. This was very important, as fuel was, and probably always would be, the greatest item of cost in smelting. Drawing their present supplies of fuel from Rhodesia, they could not hope to deliver coke to the smelting works at less than £5 per ton. Any material reduction in this price would only be expected after the Benguella railway reached Katanga, or if nearer coal-fields, as, for instance, Luano, were developed and connected to the smelting works by rail. Mr. Jadot stated that Rhodesian coke made from unwashed coal cost £6 per ton, and that it contained considerable proportions of ash and sulphur. The coke was certainly inferior, but a washing plant had been installed, and for some time a good coke, in every way suitable for smelting, had been delivered. The Union Minière were now building their own coke ovens, and the first battery, consisting of twenty-two ovens, would be ready for work in September next. A second battery of ovens would be completed at the end of the year, and when these were producing they would have a monthly supply of 3000 tons of coke, apart from some 1500 tons that the present plant at the Wankie Colliery was capable of producing. The cost of coke from their own ovens would be about £5 per ton, but, apart from the actual saving in cost, there would be an additional advantage owing to the coal having to stand the losses in transport instead of the higher-priced and more friable coke.

Another notable point in Mr. Jadot's statement was the satisfactory increase in the copper contents of the ore smelted. The ores as mined contained certain materials that interfered with and added to the cost of smelting. They had installed plant whereby these deleterious elements were in part removed, and, incidentally, the copper contents of the smelting ore increased. By these operations they were obtaining about 80% of the total copper in the ore in the form of concentrates that were well suited for smelting. The remainder of the copper was contained in a correspondingly low grade material or tailing that was stored, and suitable methods for its recovery were receiving careful attention. Extensive central works for this preliminary treatment of the ores in order to render them more

suitable for smelting were under consideration. The single furnace that had hitherto formed the smelting plant had produced about 5000 tons of copper ingots, or upwards of £300,000 in copper value. Mr. Jadot stated that a second furnace would be erected in January last, and that suitable ore-bins, &c., for the better handling of materials were under construction. Further, that a briquetting plant was being provided for the better handling of fine ores. This second furnace was now in operation and the various accessories were well in hand. The second furnace could only at present be used as an auxiliary, as the general arrangements were still incomplete, and the present supply of coke was inadequate for keeping the two furnaces continuously at work. However, everything was well in hand, and certainly before the end of next month the two furnaces should be working together, steadily producing upwards of 1000 tons of copper monthly. The present ore supplies were entirely obtained from the Star of the Congo mine. The railway was now practically into Kambove, and this great mine was being rapidly brought to a condition for supplying ore to the smelters. Mr. Jadot gave the cost of producing copper at £32 per ton on railway trucks in Katanga, so that the cost would be about £42 delivered in Europe. This agreed well with the estimate he had given them of £36 per ton of copper, as his estimate was based on obtaining coke at £5 per ton, and also, of course, of much more extended operations than those of this single furnace in which the preliminary work had been carried out. The costs would come down a further £7 per ton when the Benguella railway was completed; £5 of this amount alone would be saved on the cost of shipping the copper home. Besides, the Belgian and Benguella railways would get all the traffic. If copper fell at any time to £40 per ton, this £7 saved by the Benguella railway might be the margin of profit.

The foregoing covered the main items of the treatment of the ores, but they had a very serious problem in the native labour supply of the future. Up to the present the native labour had been quite equal to all the requirements of mining and smelting. They had, however, been carrying on extensive development and erection operations, and these had to a certain extent interfered with the productive work. They had been depending to a large extent upon Northern Katanga for their natives, and this district had turned out a complete failure. The natives were physically poor, and the supply was quite inadequate. This was now being altered, as a result of agreements entered into with the Rhodesian and Portuguese authorities. Even now a fair supply of suitable labour was being obtained, but if the great mineral deposits of Katanga had to be rapidly developed, the labour question would have to be energetically taken in hand.

They were now considering a further large extension of the smelting plant, and additional furnaces would be put in hand within the next two or three months. This would bring the smelting plant up to, probably, six furnaces, and the output of copper up from about 12,000 tons per annum to about three times that amount. The Union Minière Company had already provided the necessary finance for these furnace extensions.

The motion carried unanimously

TRONOH MINES, LTD.

THE eleventh annual general meeting of the shareholders of the Tronoh Mines, Ltd., was held on May 22, at the Cannon Street Hotel, E.C., Mr. C. V. Thomas, chairman of the company, presiding.

The Chairman said that the Board and the shareholders had reason to congratulate themselves upon the satisfactory results of the year's work. Before contrasting the figures with those of the previous year, he must remind them that 1911 was marked by quite exceptional circumstances, and, as was mentioned at the previous meeting, the returns were such as they could not hope to maintain. Bearing this in mind, they found that in the profit of 1912 there was a decrease of £27,749, but, nevertheless, having regard to the fact that the capital was only £160,000, the profit of £157,798 could not be regarded otherwise than as highly satisfactory, and it fully corroborated the forecast made by the manager towards the end of 1911. In the value of the tin sold there was a decrease of £87,760, the quantity being 1080 tons less than in 1911, when the returns were unjustifiably high. On the other hand, the value realized last year was about £12 10s. greater than in 1911. It was an encouraging feature that the costs at the mine had decreased by £60,583, and the cost per ton was £62 7s in 1912, as against £60 8s in 1911, the tonnage itself being less, as already stated. As regards working cost, the manager in his report said: "The increased depth—the greatest ever worked in this country—has rendered the work increasingly difficult and expensive. Severe falls of ground have occurred, which have militated against cheaper working. The costs of labour and material have increased very greatly, and there appears to be no hope of their immediate reduction. It is considered that the minimum costs under our conditions have been reached, and that they are not likely to be further reduced." Shareholders must, therefore, not look for any further reduction of cost, but rather for some slight increase. With regard to the profit and loss account, they had, as before, provided for depreciation of machinery and plant on a 15% basis, and the balance sheet showed that certain additions to plant had been effected during the year, at a cost of nearly £6000. Of the £103,534 shown as investments at cost, over £70,000 was in gilt-edged securities. During the year they had maintained regular quarterly dividends of 2s 6d per share, which they regarded as the right policy, dealing with the balance of the profits in the form of bonus, which they were enabled to declare at the rate of 5s. per share.

The manager in his report expressed his anticipation that in 1913 they would continue to have the good returns enjoyed in 1912, but in addition to the principal mines themselves they had large areas of proved tin-bearing ground available for treatment. In conjunction with the general manager, the Board had given careful consideration to the question of treating this ground by hydraulic mining. For this purpose it would be necessary to arrange, some distance away, to raise a large volume of water to the height necessary to secure its flow into the company's property, and the work would involve an expenditure of between £80,000 and £120,000 of capital. Investigation led the Board, with the acquiescence of the manager, to abandon that scheme, and subsequently the general manager expressed the view that these areas were eminently suited for treatment by a system of bucket-dredging. The directors took advantage of the presence in the East

of a representative of the firm of Messrs. F. W. Payne & Co., Mr. A. C. Perkins, who was an expert in dredging. Mr. Perkins made a report confirming the opinion of the general manager. The cost of the plant, capable of treating 80,000 to 90,000 cubic yards per month, would be from £35,000 to £40,000, and orders would be given at once for its installation.

Mr. F. D. Osborne seconded the resolution for the adoption of the report, and it was carried unanimously.

OURO PRETO GOLD MINES
OF BRAZIL, LTD.

THE twenty-second ordinary general meeting of the Ouro Preto Gold Mines of Brazil, Ltd., was held on May 21 at the offices, 6 Queen Street Place, E.C., Mr. John Taylor presiding.

The Chairman said that during the twelve months under consideration 68,486 tons of ore were raised, resulting in the production of 27,613 oz. of gold. While not constituting a record, the total value of £106,804 had only once been exceeded in any previous year. The yield per ton was £1 11s. 2½d., which was a record for the company, while the working costs were £1 6s. 8½d per ton, or about the same as in the preceding six months, but somewhat higher than the average for the past few years, owing to the increase in payments for wages and in the prices of materials purchased locally. He referred at the annual general meetings, both last year and the year before, to the dearth of labour at the mines, and he was sorry to say that this trouble remained with them notwithstanding the steps which had been taken to improve matters. About twelve months ago they had a full complement of miners, but the numbers gradually fell off from various causes until October, by which time they had lost over 300 men. Since that time but little improvement had shown itself, and it had been found necessary to again increase the wages in the hope of attracting more workpeople. This shortage of labour was causing much anxiety, and several schemes were under consideration, having for their object the encouragement of emigration to Brazil. They learnt that the scarcity of labour was being felt throughout the country, and it was without doubt caused by the large number of men employed in the construction of railways, and upon other public works. A ray of hope came to them in the very latest letters to hand from the superintendent, in which he spoke of a rumour, which was believed to be authentic, that the Brazilian Government was about to discontinue many of the railway extensions now in progress, in which event they should surely have men returning to seek for work in the mines again. The profit for the 12 months amounted to £14,296; £3928 had been written off the buildings, machinery and plant as depreciation, and £5000 had been written off the same items, in accordance with their policy of paying for all new plant out of revenue; £3663 had been paid as dividend on the preference shares. The scheme for utilizing some of the spare water power for generating electricity for lighting some of the streets and houses in the neighbouring city of Mariana was completed and brought into operation in the month of June last year, and had given the fullest satisfaction. He proposed the adoption of the directors' report and accounts.

Mr. Marcel Paisant seconded the motion, which was carried unanimously.

REZENDE MINES, LTD.

THE fourth annual meeting of the Rezende Mines, Ltd., was held on May 29, at Salisbury House, E.C., Mr. Sidney H Farrar (chairman of the company) presiding.

The Chairman said that the Rezende Mines, Ltd., had during the year taken over the Penhalonga mine. The working expenditure and revenue account showed a profit for the year of £24,987, or 5s. 3 3d. per ton, to which must be added £5,785, received from tributors by way of royalty, making a total of £30,772. This amount was almost exactly double the profit made in 1911. The profit per ton was rather less, that for 1911 having been 5s. 9 6d. per ton milled, as against 5s. 3 3d. per ton this year. This was accounted for by the fact that they were now including Penhalonga ore, the grade of which were much lower than the Rezende grade. As far as the Board was capable of judging, the accounts disclosed a very sound position. During the year they crushed 94,613 tons and shipped 1029 tons of concentrate, the value per ton milled being 26s. 8 5d. This was about 6d. per ton lower than in 1911, but was accounted for by the lower grade of the Penhalonga mine, already referred to. Working expenses were about the same as in 1911, namely, 21s. 5 2d., as against 21s. 4 6d. The results of operations since the end of the year under review, namely, for January, February, March, and April this year, showed that the estimated profit for the four months was £9948, or at the rate of £2487 per month, or 5s. 7 8d. per ton.

The ore reserves in the Rezende section amounted to 145,599 tons (being about 7000 tons more than in 1911), and in the Penhalonga section to 75,496 tons—a grand total of 221,095 tons. Of these 101,579 tons had an estimated value of 7 38 dwt. The value of 44,020 tons in the old West workings had not at present been ascertained. On account of the nature of the large orebody there, they could only arrive at a valuation through the mill. Of the Penhalonga ore reserves it was not possible to estimate the value with any certainty, but during the first four months of this year the value per ton milled had averaged about 18s. 7d. As regards the Rezende ore reserves of 145,599 tons, while they showed a slight advance on last year, they had hoped to have done better. But, unfortunately, they struck additional water in what was already a wet mine, and the pumping plant was unable to cope with it, thus retarding development. They had sent out three additional pumping units capable together of dealing with about 1000 gallons of water per minute, of which one was already at work and two on the way to the mine. They derived a fair revenue last year from tributors, the bulk of which came from those working the old West workings. Their agreement expired at the end of April of this year, and under that agreement this company took over their crushing plant on satisfactory terms. A manager (a former Rand mine manager of experience) had been appointed for this section, which was at a considerable distance from the main mine, and the company would in future work this section on its own account, the manager acting, of course, under the instructions of the general manager.

As regards the general position of the company, the general manager's report set this out very clearly, but he would like to amplify his remarks by stating briefly

the programme which the Board were endeavouring to carry out. As far as could be seen, the Penhalonga mine could be worked at a profit for some little time, but for how long it was impossible to say, as it all depended on the orebodies which exploration from the 5th level might disclose. The Penhalonga ore, as had been known for a considerable period, contained a base metal, which, if it could be extracted on a commercial basis, might add considerably to the profits of the company. The Penhalonga company made various experiments in the past, but without success. The conditions under which this product could be marketed having, however, altered, the company had now arranged to carry out a series of experiments in conjunction with the firm who treated the concentrate, and an expert had been engaged with a view to seeing whether anything could be done in the way of extracting this metal profitably. If it was proved to be practicable, it might quite possibly mean an indefinite lengthening of the life of the mine, but he was not in a position to say anything more at the moment. The hope of being able to increase the output lay largely in the old West workings, which had disclosed a large orebody assaying approximately 5 dwt. The general manager stated that the opening of this orebody on the third level should enable him to lay down for the guidance of the Board some definite policy for the handling of a large tonnage in this section of the mine. They had acquired from the tributors of these old West workings under the agreement with them, a 10-stamp mill, with which they crushed 42,564 tons last year, and it would be quite easy to increase this plant from stamps now on the property, should results warrant it. Briefly, therefore, they might expect to bring in a fresh section of the Rezende mine to meet the day when they would no longer be able to work the Penhalonga profitably. He could not, of course, tell what the old West workings might develop into, but they were certainly very hopeful of them, and it was quite evident that the tributors who worked them up till April of this year were able to treat the ore at a profit. He might mention that they were working the surface section, from portions of which, at all events, the richer ore had, as far as they could judge, already been extracted by some ancient race.

Of course, in mining, especially in quartz mining, it was very dangerous to prophesy, but they were today certainly in a very sound position. They could see their way a certain distance ahead, and they had every hope that the old West workings would help them very materially, so that they might look forward to the future with a considerable amount of confidence. They had to deal with a very wet mine as far as the Rezende main section was concerned, necessitating a number of small pumping units. The aim of the Board was to keep capital expenditure as low as possible. A great deal depended upon how the old West workings developed, but, as far as they could see, the Board did not look forward to having to face any great outlay under this head. Mr. Jameson, the general manager, came home on leave during last year, and Mr. R. W. Robinson took charge of the mine temporarily, and he was glad to pay a tribute to Mr. Robinson for the extremely able way in which he carried on the work during the general manager's absence. The general manager referred in his report to

an experimental cyanide plant which had been erected for the purpose of testing the very considerable accumulation of tailing from the Penhalonga mill. So far the experiments had not proved that the tailing could be profitably treated.

The present directors of the company were only four in number, and, as a very considerable amount of work devolved upon them, he proposed to ask them to sanction the election of Captain J. P. Farrar as a director.

Mr E. M. Clarke seconded the motion for the adoption of the report and accounts and it was carried unanimously.

BRAKPAN MINES, LTD.

THE annual general meeting of Brakpan Mines, Ltd., was held at Johannesburg, on May 27, Mr W. L. Honnold (the chairman) presiding.

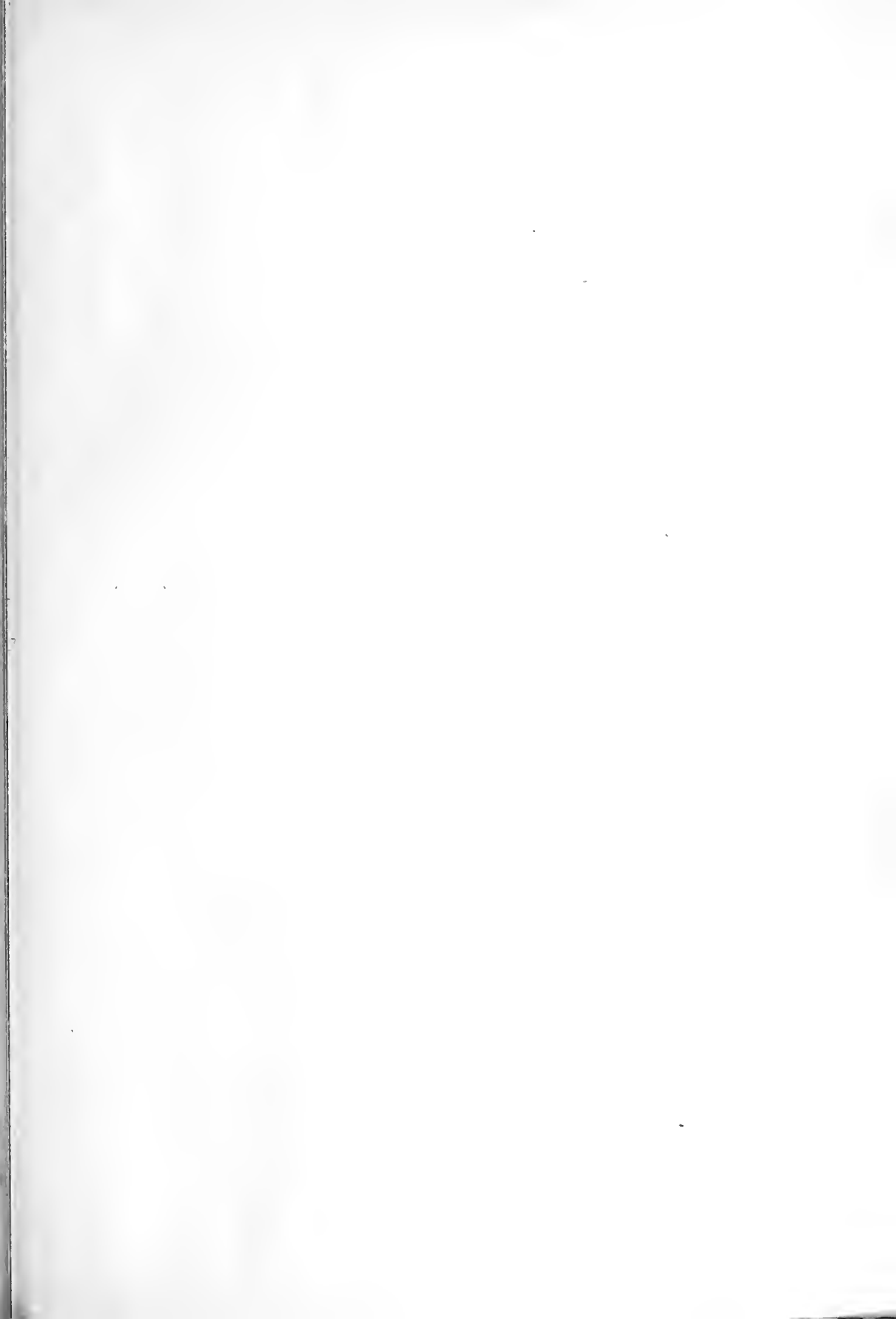
The Chairman said that the technical circumstances affecting and controlling the year's results had been explained in the report of the consulting engineer. He had made it clear that, in pursuance of the previously declared policy, every available working place was drawn on to the full extent of its tonnage capacity. Until development had been so far advanced as to provide stope faces in excess of the demands of the mill, no other policy was open, except the restriction of output, which obviously was undesirable. They had always been of the opinion that the policy would probably result in a recovery above or below that indicated by the reserves as a whole. It was because of this feeling, and in order to further guard against misconception, that during the first few months of the year they arbitrarily kept the declared grade at between 28s and 29s by holding back gold in reserve, a course subsequently abandoned for reasons stated by the chairman at the last annual meeting. It was gratifying to find that results had so far shown less fluctuation than anticipated, and that the average grade for last year was but little above the estimated average of the ore reserves. Furthermore there was cause for satisfaction in that the excess recovery was to a considerable extent due to unusually good development, which concurrently enabled them to come forward with an ore reserve of the same estimated value as at the beginning of the year. Notwithstanding these reassuring considerations he felt that he should again remind them that the nature of the mine, the manner of its opening, and the policy of working, were such that the best return to shareholders could not be secured without incidental variation. Once surplus stopes were available, it would be open to them to exercise a degree of control, but, even then, they should hesitate to sacrifice efficiency to the fetish of uniformity. What he had just said as to grade applied for the time being to tonnage as well, for, until there was a surplus of stopes, it was inevitable that tonnage would suffer in the event of any considerable curtailment of the capacity of the faces, whether incidental or accidental.

With regard to capital expenditure, this would provide extra native and hospital accommodation, also two tube-mills and the forty additional stamps required to complete the mill. The mill additions would be utilized in the first place as a safeguard against irregularity in the power-supply, as well as to secure finer grinding and better extraction. An increase in

the tonnage crushed might ultimately result, but this was not the immediate and primary consideration. The ore reserve was increased by over half a million tons to a total of 2,157,000 tons, averaging 6.74 dwt over a stoping width of 61 in.

The question of the next dividend had not yet been considered by the Board, and would not be brought forward until the actual position for the half year had been more clearly defined. He confessed he deprecated attempts at prediction in this connection. It had to be recognized that the recent dislocation of operations might have proved so disconcerting to some shareholders as to call for a word of reassurance. He therefore ventured to say that he saw no reason for anticipating less than 20% in June. It might be possible to pay a higher rate without encroaching upon the balance brought forward from last year, but he would prefer to keep the way open for the Board to follow a conservative course.

The native labour supply improved during the year, and, on the whole, was equal to requirements. With the formation of the Native Recruiting Corporation, the previously prevalent cut throat policy of the groups as to recruiting disappeared. The recruiting organization of the Consolidated Mines Selection Company, which served this company so well in the past, was being liquidated, and would no longer appear in the financial statement. With regard to the bearing on their operations of the Government's recent decision to stop the recruiting of tropical natives it was too soon to express an opinion. All he could do was to point out that the mine was on an exclusively machine-mining basis, and was provided with other mechanical appliances which ensured certain advantages in the event of labour shortage. The recent interference with operations was in the way of early correction. The trouble arose through an unusual subsidence of hanging wall in some of the most important stopes. Roof subsidence in itself was a matter of no special concern, in fact, it was an essential feature of their system of mining, and had occurred from time to time almost from the beginning. As a rule it took place more or less in accordance with expectations and without material inconvenience. In this instance, however, the stopes concerned were particularly large, and, furthermore, were closely adjacent. The movement, therefore, was much more extended than usual, and not only blocked the faces at a number of points, but also covered some of the stope tracks. The consequent disorganization had been greater than was at first anticipated, and earnings suffered accordingly. In all probability the management would have experienced little inconvenience, and there would have been but a comparatively small curtailment of profit—in fact the matter would perhaps not have been heard of—if the stopes concerned had remained intact only a few months longer, or until others, now in course of opening, were ready to supply an equivalent tonnage. It was really because of the inopportuneness of the incident that its bearing had been so unduly distorted. It was unnecessary to say more in this connection, except that the stopes were again in stable condition, although on a curtailed basis of output, and that they did not expect a recurrence of similar trouble. The mine was gradually getting into its stride again, and May would show an improvement in results, the probability being that over 56,000 tons would be milled, of a grade somewhat better than that of April. In July the additional stopes would exert a favourable influence.





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